N. NADEZHDINA

THE SUBVIEWER PUTS TO SEA

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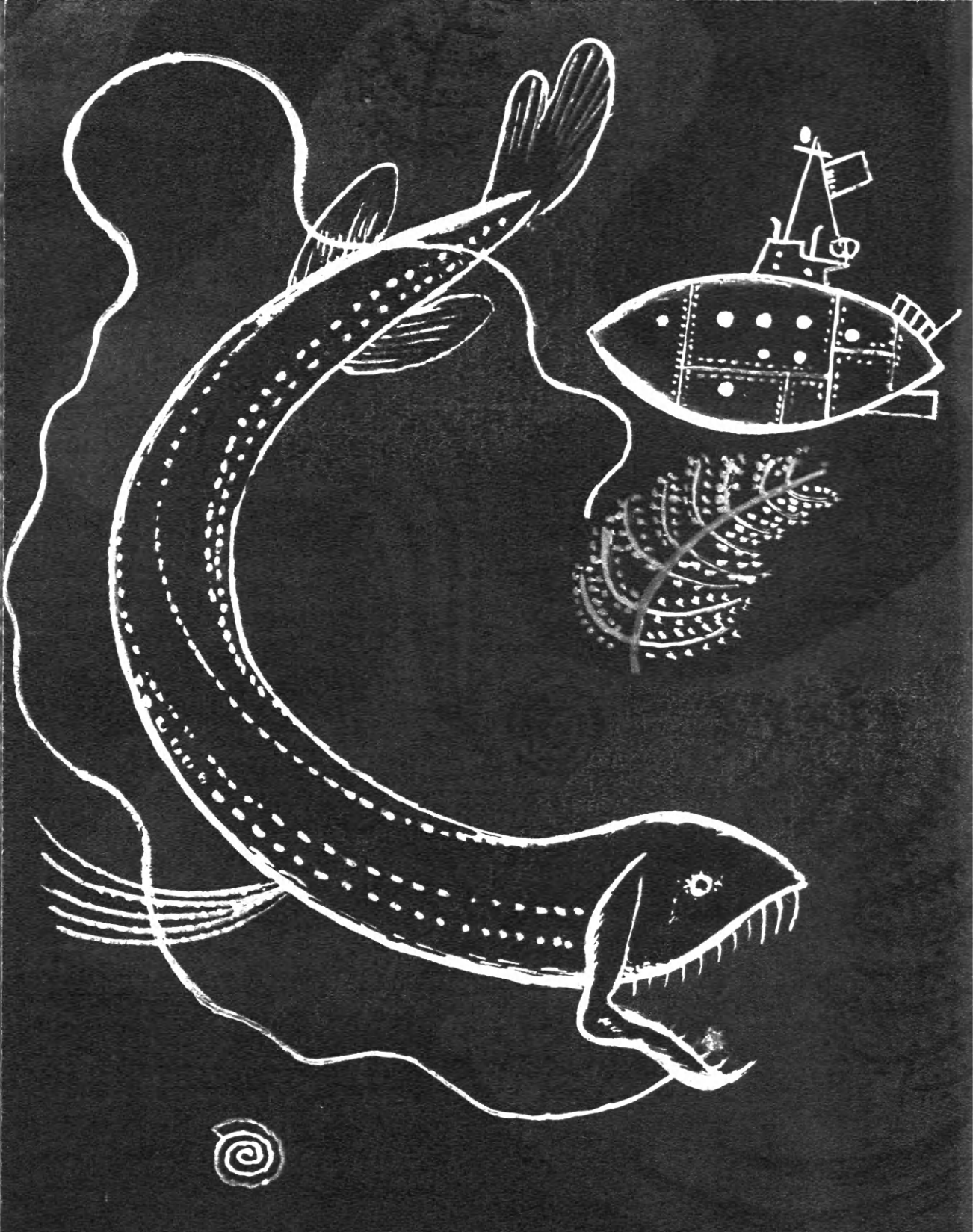


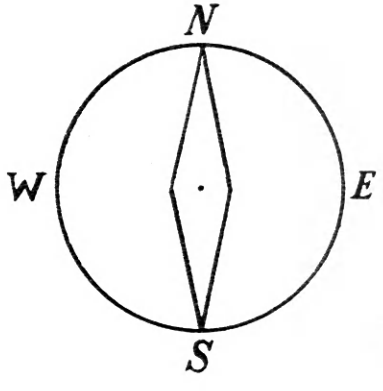
N. NADEZHDINA

THE "SUBVIEWER" PUTS to SEA

or

Voyage into the depths of one ocean and five seas by the mysterious

S5A



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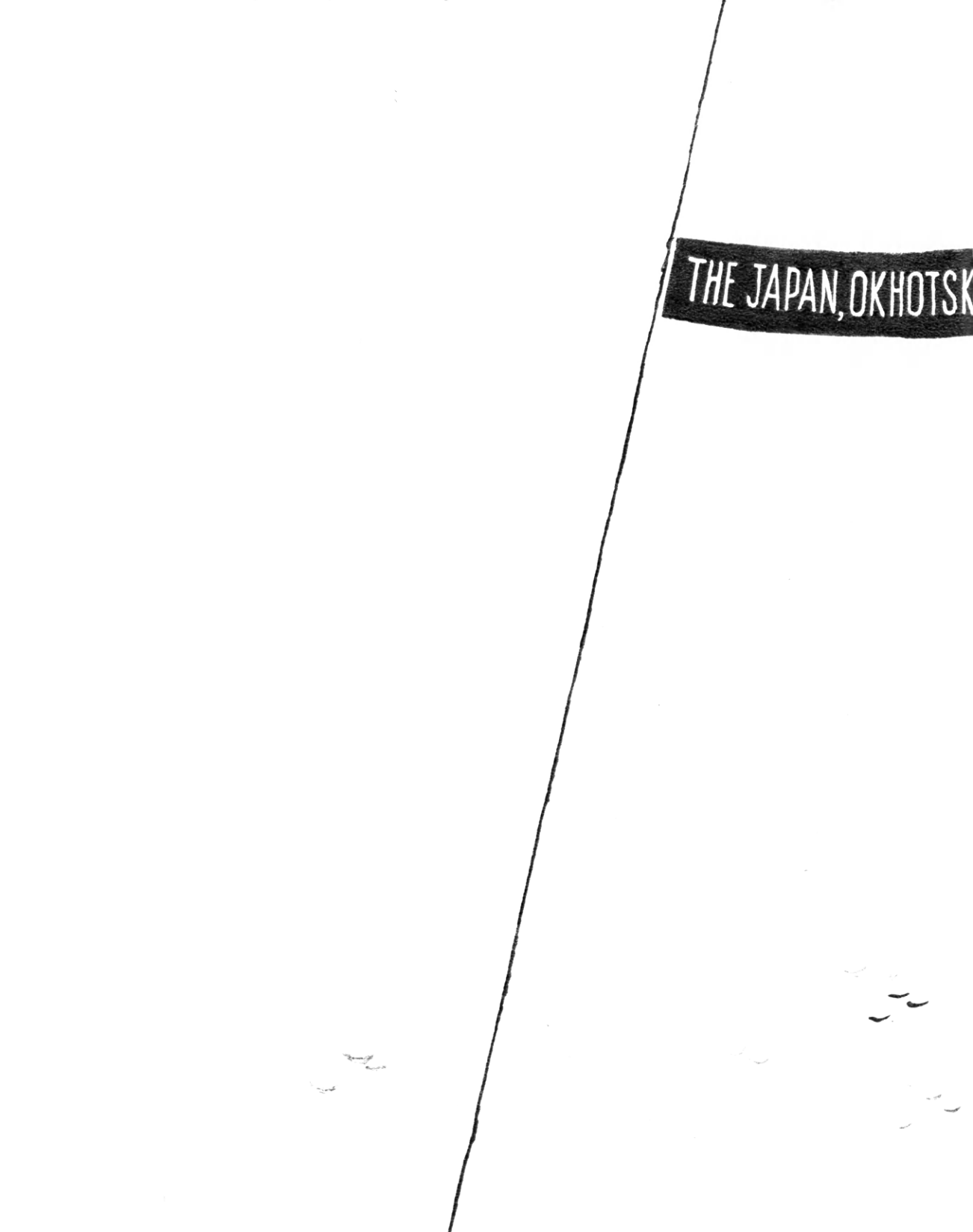
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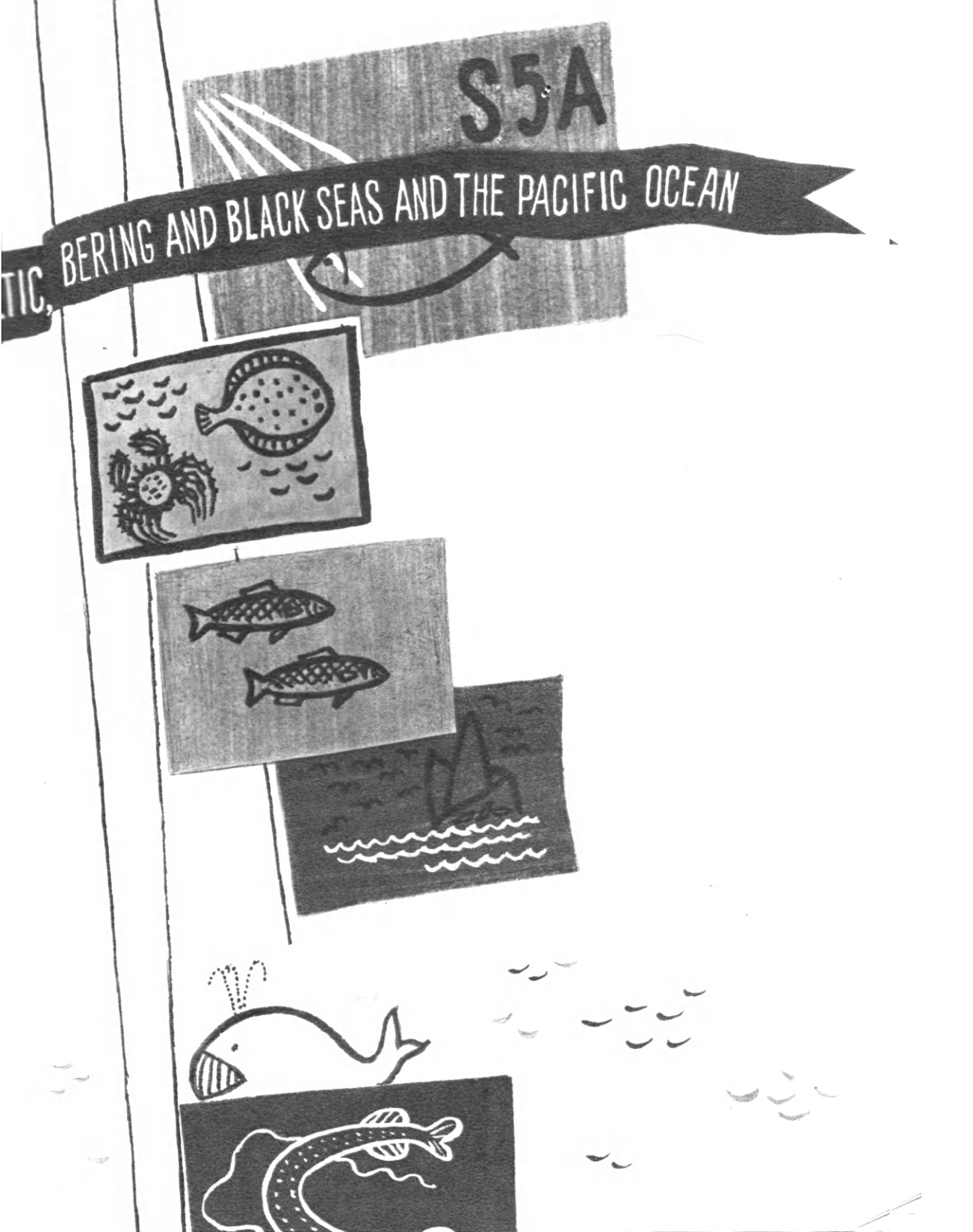
S5A
TIC, BERING AND BLACK SEAS AND THE PACIFIC OCEAN

TRANSLATED FROM THE RUSSIAN
BY STEPAN APRESYAN

EDITED BY BERNICE MORRIS

DRAWINGS BY B. KYSHTYMOV

НАДЕЖДА НАДЕЖДИНА

«МОРЕВИЗОР» УХОДИТ В ПЛАВАНИЕ

На английском языке

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PART ONE

THE SEA IN THE HOUSE

BOYS ARE THE FIRST TO LEARN THINGS

I still have the logbook of that unusual expedition in my desk. I came by it in a curious way. I might never have learned the secret of the mysterious ship S5A if—but I must begin at the beginning.

Leningrad normally greets visitors with rain. But I was lucky. I shall always think of September in Leningrad as a month of sunshine and gold. Gold in the sky—spires and domes and treetops. Gold in the water—the reflections of autumn gardens. A golden city.

One day I took a walk along the river, past the Winter Palace. There was a tang of the sea in the air. Gulls were screaming. A tug puffing out clouds of smoke was towing a huge barge. Two boys standing on the granite steps that ran down to the water were watching her.

"Landward wind," one of the boys said. "See the way the smoke's drifting?"

"Yes," answered the other. "When are we going to see the S5A off, Seryozha?"

"What a time to ask! The S5A sailed at 09:00 hours this morning. She must be far out to sea by now. I think—"

Just then the boys saw me. They looked at each other and ran off down the steps.

In the evening I had a visitor, an old friend of mine who worked in the harbour. I recalled the conversation I had chanced to overhear.

"Tell me, Victor," I said, "what is this ship, the S5A, that sailed at 09:00 hours this morning?"

My friend knew nothing of any such ship. In fact, he swore that no vessel had put to sea at that hour.

"Perhaps it was a submarine?"

Victor laughed.

"Or an invisible ship?" he said. "Must be if she can put to sea without anybody knowing it. Where did you hear about it?"

"Two boys were talking about it on the embankment."

"Just boys' talk."

But I could see that Victor was worried. He left soon.

Around midnight my telephone rang.

"Not sleeping yet?"

"No, as you can hear."

"Any idea where I could find those boys of yours?" said Victor after a short pause.

"No. I came upon them quite by chance."

"I'm sure it was just talk. But I can't put it out of my head—I've been using the phone, asking questions, bothering people. They laughed at me, of course. I wish I could see those boys. But you don't know where they are, eh? I'm sorry. Good night."

I could not go to sleep, however. Of course there are no invisible ships, but still—Victor has said "those boys". I've had a lot to do with boys, and I insist that boys are always the first to learn the things they want to know.

REAPING WHAT YOU DID NOT SOW

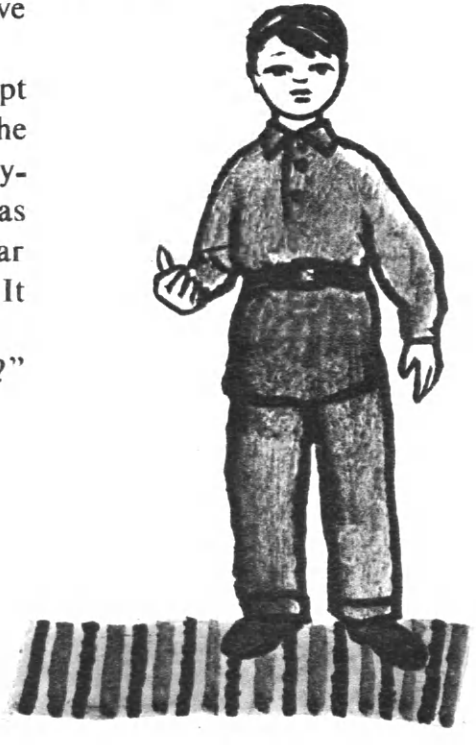
It is nice to have windows looking on a quiet street, with no trams and buses, and your neighbours out at work from early morning. You can think and write then to your heart's content—it's so quiet!

But living on the ground floor has its drawbacks, I soon realised. Passers-by talk right into your ear. Just now two girls stopped to chat under my window, and unwittingly let me into a game to play. They called the game "The Sea in the House". The elder girl was telling the younger one all about it.

"You must name everything in your room that comes from the sea. For everything you name right you score a point."

"I couldn't think of a thing!" piped the younger.

"Yes, you could. I'll help you. I've already got six points."



The voices died away. But I kept thinking about "The Sea in the House". Was there in the flat anything that came from the sea? I was thinking so hard that I didn't hear the knock on the door at first. It was Alyosha, my neighbour's son.

"Have you got any iodine, please?" he asked, sucking his finger.

I took a bottle from the medicine chest.

"Here. Give me your hand. One point. How did you manage to cut your finger?"

"I didn't cut it, I pricked it. With a pair of scissors. I was

uncorking a bottle of cod-liver oil. Mother's got the idea I should drink the nasty stuff."

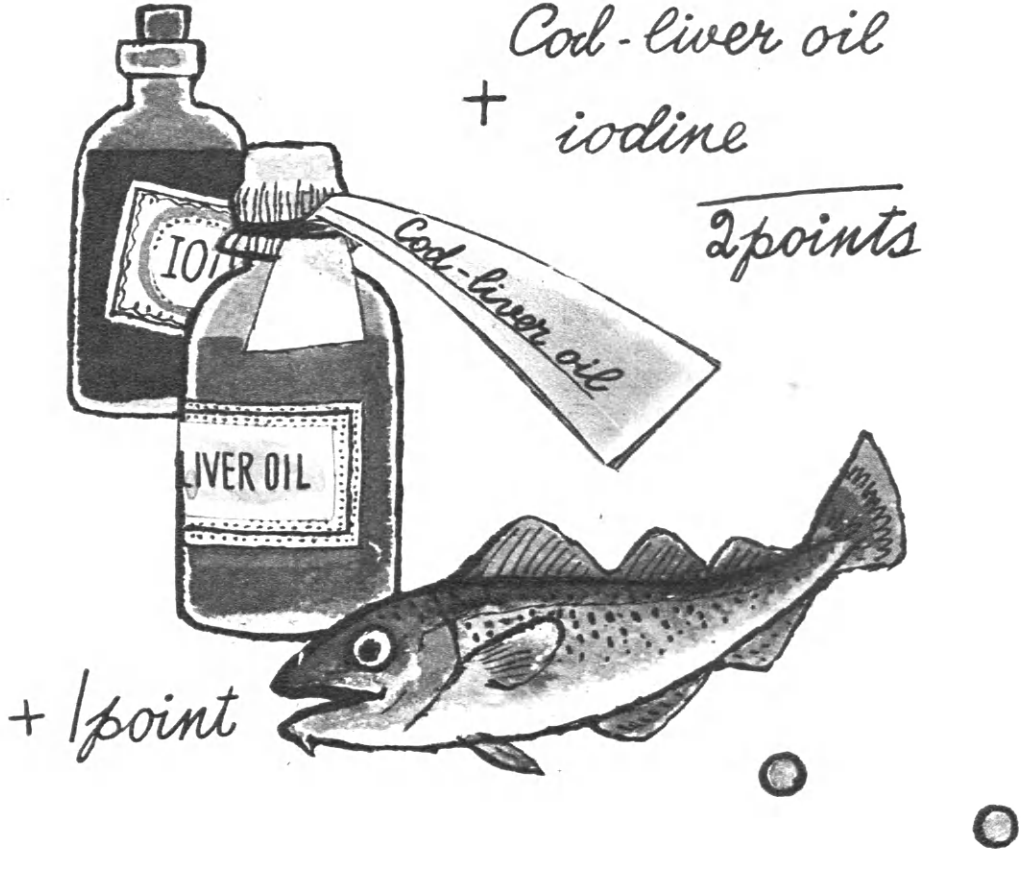
"An excellent idea. Two points."

"What's the score you're keeping?"

"I'll tell you."

I told Alyosha about "The Sea in the House" and our first two points.

As you sow, so shall you reap, says the proverb. But sometimes people reap what they have not sown. That happens when they reap in the sea instead of in a field. The machine they use has no wheels. I should say it is more like a housewife's shopping net than a machine.



The reapers lower a huge metal net and drag it across the sea-floor. Its sharp edges mow the seaweeds. When it is hauled up the water runs out leaving a sheaf of weeds in the net-like mower.

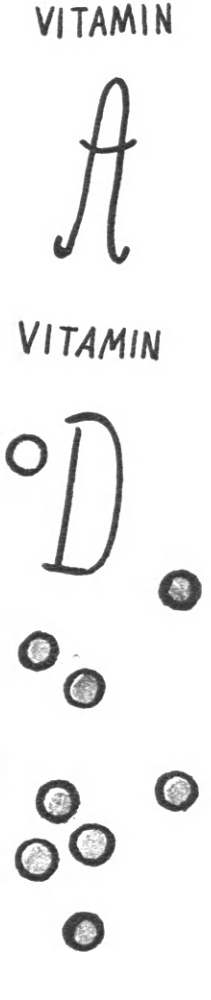
In the Far East, people mow the alga called Laminaria. They mow the phyllophore, a red alga, in the Black Sea. Academician Zernov, a Soviet scientist, discovered an undersea field a hundred kilometres long and fifty kilometres wide in the Black Sea, not far from Odessa. It's red with phyllophores.

Iodine comes from the phyllophores and laminarians. It may be taken internally as a medicine, but in the case of children it is usually put on the outside. You have probably pulled a sorry face when it was applied to a cut in your finger or to a bruised knee. Iodine burns, but then it keeps the injury from getting infected.

We have said that iodine is a medicine that grows on the sea-floor. But there is another one that swims in the ocean. This is the cod. It's a fish housewives like to buy because it has white, juicy flesh and few bones.

The flesh of the cod goes to the shop and its oil to the chemical factory. Cod-liver oil is rich in vitamins A and D, which is particularly necessary for children. It prevents rickets and scrofula and promotes normal growth.

We usually buy cod-liver oil but the oil obtained from that sea robber, the sharp-toothed shark, is just as useful.



Some people do not like the smell of cod-liver oil, but if you eat a piece of rye bread and salt with it you will hardly notice the smell.

"Let us play," said Alyosha when he had heard my story. "We'll get more points than that girl. I'll tell the others. I shan't be a sec."

With Alyosha gone, it was much quieter in the flat. In the silence I heard the water dripping in the bathroom.

That Alyosha! He had remembered to wash his finger but had forgotten to turn off the tap.

I stepped into the bathroom. As I was reaching for the tap something cold and wet gave me a gentle thump on the shoulder.

The sponge had fallen from its hook. I quickly hung it up again, and scored my third point.

THE SEA IN THE PUBLIC BATHS

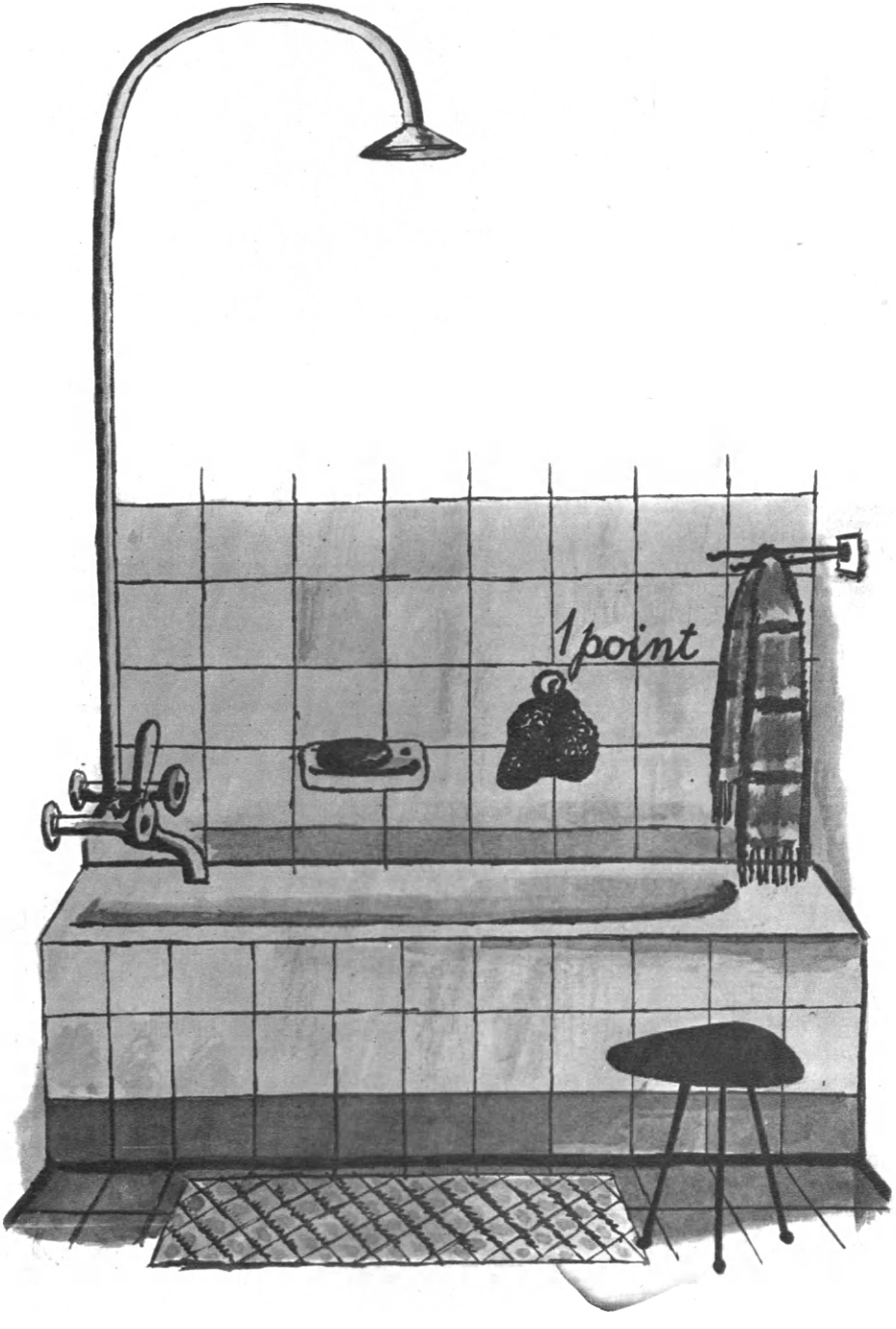
Next time you go to the public baths, see who uses what. Some favour a tuft of bast, others the pod of a plant called loofah, and still others rub themselves with the chamois-soft skeleton of a marine animal, the sponge.

It's a queer animal, is the sponge. It has no feet, heart or head.

A sponge clings to an undersea rock and stays there all its life. And this is why for a long time it was mistaken for a plant.

There is no reason for the sponge to move about looking for food since food flows right into it.

It has a body full of pores and countless channels. The walls of the channels are composed of cells equipped with cilia, tiny hair-like organs. While the sponge itself is as motionless as a rock, the cilia quiver all the time. In this way water from which the sponge strains


1 point

out its food—minute crustaceans, infusorians and other tiny creatures—is drawn into the openings in its body.

The sponge is so hardy that any bits cut off from it soon grow into new living strainers.

Man has known the sponge for more than one thousand years. In ancient Greece and Rome, sponges were used for washing and for drinking from. The Roman soldier used a sponge as a field water bottle—it never broke and from it he could refresh his parched lips.

The sponge we use in the bath is the dried remains of the horny sponge. It is silky and soft.

But there are sponges with a skeleton so hard it easily cuts fishing nets. You would hardly want to rub your back with a sponge like that.

Sponges vary in form. Nor is this accidental. You have only to look at a sponge to tell at what depth it must have grown.

A ball sponge can stand the blows of the surf. Flat and ball-like sponges live in shoals. They are not afraid of waves.

At greater depths which the swell never reaches live goblet-like sponges. They are longer and taller than the others.

One of these, which is three feet tall, scientists have named "Neptune's goblet"—after the Roman god of the sea.

Even more grotesque is the skeleton of the glass sponge, composed of fine silicon needles that are as brittle as hoarfrost. It's like flimsy lace and would shatter with the slightest movement of the water. That is why it is found only at several thousand feet, in perfectly still waters.

I wanted to tell Alyosha all this but he had not come back yet. However, soon a loud ring at the door told me he had not been wasting his time.

Two girls stood in the doorway.

"Good day," they said in unison. "We play 'The Sea in the House' too. Alyosha sent us over. Tell us, please, does this come from the sea?"

One of the girls held out a tin of crab meat and the other a herring's tail.

"Yes." I smiled. "Two points for you."

But I did not smile long. The bell rang again. A boy from the third floor wanted to make sure of the marine origin of a small fish in his aquarium. We decided that he should wait in the corridor while I consulted my books. But when I came back he had vanished.

However, I had a feeling that I wasn't alone in the half-dark corridor. I thought I could hear somebody breathing. The funny thing was that the sound came from somewhere on the floor. I took a step forward and yelled as something clutched my foot.

"Oh! Who's there?"

"It's me," said a voice at my feet. "Shurik from the third floor. Kolya has gone to fetch the aquarium. He'll bring it in a minute."

"Well, well! And why are you walking on all fours, Shurik?"

"I lost my fish."

"What fish?"

"A slippery one—a lamprey. I was bringing it to you but it slipped out of my hands. I can't find it."

"Wait, I'll help you. Only remember, Shurik, the lamprey isn't a fish. It has neither jaws nor paired fins like a fish. It reminds us of very long ago when there still lived jawless animals, the most ancient of the vertebrates. There are no such animals any more, except for the lamprey and the hagfish. They all became extinct three hundred million years ago."

I turned on the light and helped Shurik find the ill-fated lamprey. We peered into the creature's mouth, which was like a sucker. What

surprised Shurik most of all was that the lamprey had teeth on its tongue.

Again and again the bell rang. Boys and girls kept coming in from the five floors. Alyosha had alerted the whole building. Everybody wanted to play "The Sea in the House".

In vain did I assure them that all they had to do was report a find. They would not listen. They all brought their finds with them.

My flat was like an aquarium displaying gold-and-silver Baltic herring, red-fleshed salmon, narrow-faced grey mullet, and plaice as flat as a pancake. Two boys, alike as two peas—they must be twins—lined up tins labelled "Mackerel", "Spiced Sprats", "Sardines", "Humpback", and so on. There was also a piece of paper dotted with the black beads of caviar.

Only one little boy stood aside, blinking fast and almost crying.

"I've got nothing from the sea!"

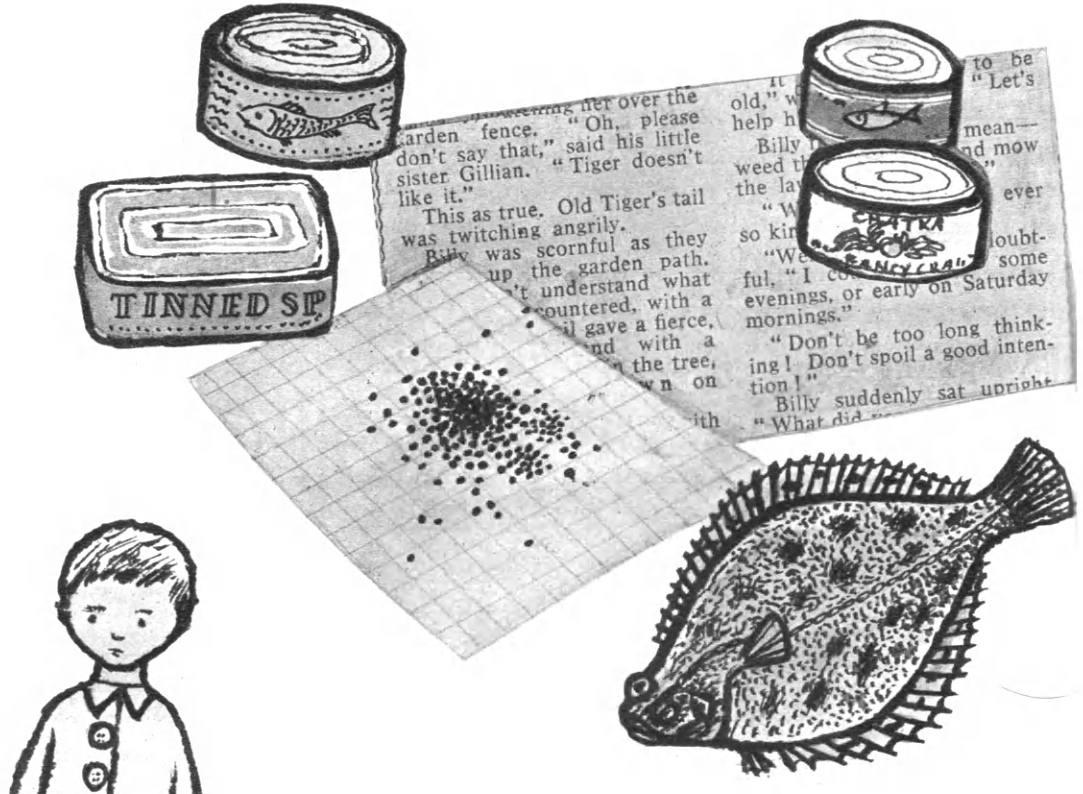
"Yes, you have. What about that button on your jacket? It's made from the shell of a mollusk called the winkle. See how it shines green and pink. It's mother-of-pearl. In olden days Russian travellers in the tropics saw disks of mother-of-pearl as big as dinnerplates. The disks were used to make windowpanes for cabins. A pane of mother-of-pearl kept the cabin light and cool. It didn't let in heat rays."

Shurik stared at the button for a long time.

"So buttons can come from the sea," he said. "We were only thinking of fish."

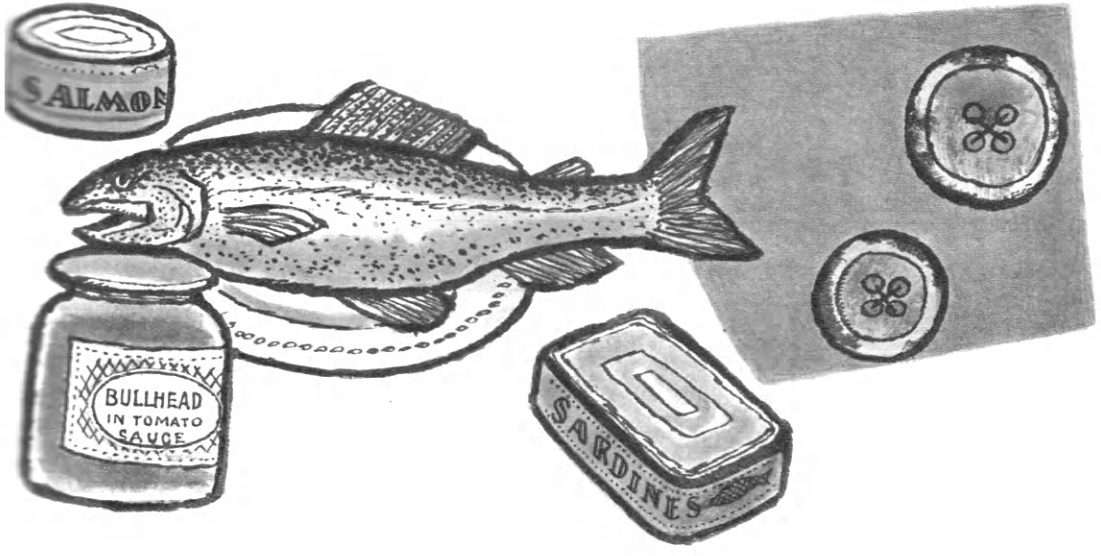
"No, not fish only. In the sea there are seals and walruses. In a Chukchi village you may see a walrus head stuck on a pole. It's a trophy of the chase. After a lucky walrus-hunt there's a good supply of meat and fur and fat in the hunters' houses. Seals provide fine fur. But the best fur is the fur seal's.

"Sea-birds nest on cliffs. The eider duck is famed for the wonderful down it uses to line its nest. The down can't be blown away by the wind or wetted by water. The overcoats of polar explorers and



the overalls of flyers are lined with eider down. It's so light and warm that one or two hundred grams in a coat would be enough to keep you warm in a frost.

"In warm seas there are turtles. The leathery turtle is one of the giants of the sea. Its shell weighs half a ton and is like a huge cauldron. But for all that the turtle is an excellent swimmer and not easy to keep pace with. Turtle meat makes delicious soup and its shell can be made into beautiful combs and other articles."



"Combs?" said one of the twins, giving his brother a wink. "Come along, Igor."

The others followed them out and I found myself alone in the room. But I did not have much time to relax.

The bell did not ring any more. There was no point in locking and unlocking the door every minute. I simply stood on the landing while the staircase rang with the clatter of feet and the sound of children's voices.

Coral beads flashed in front of me. Somebody was crawling about the stairs, picking up the imitation pearls he had dropped. Somebody else was brandishing a paper-knife made of walrus ivory.

Alyosha stood by my side, counting.

"Eighteen, nineteen, twenty—"

Kolya came downstairs, pressing his fish bowl to his chest. He tried to get by a little boy carrying a shell ash tray but stumbled and emptied his bowl over a girl with an eider-down muff.

"Don't worry," he told the girl. "Water doesn't wet eider down."

Shurik came in sight, holding a pair of fur slippers high above his head.

"Granny says they're sealskin!" he shouted.

In the end a woman appeared on the stairs. Her restless eyes lingered on my face.

"Are you in charge of this game? Please stop them, or my coat will be ruined!"

"I'm sorry but what coat do you mean? Who do you want me to stop?"

"Who! My sons, the twins! They took my tortoise-shell comb out of my hair. And now they want to take my coat out of the wardrobe. It isn't sealskin. It's rabbit but I treasure it all the same."

"Why didn't you say so in the first place, Maria Sergeyevna?" Alyosha grumbled. "Nobody'd have touched your rabbit. We know rabbits don't live in the sea."

"It's another of your tricks!" Maria Sergeyevna went for Alyosha. "I wonder what you'll think up next. Perhaps you'll take the furniture out?"

I listened. There was a crash upstairs, as if somebody really were taking the furniture out.

"Alyosha, what's that noise I hear?"

Alyosha shrugged his shoulders.

"Nothing special. The twins' granny sleeps on the sofa and they're trying to find out if it's stuffed with seaweed. But they needn't drag it out. They can find out another way, like I told them—just rip the upholstery a bit."

"What do you mean, rip the upholstery?" shrieked Maria Sergeyevna, rushing upstairs.

"As you were!" I said to Alyosha.

He clicked his heels.

"Very good." And he, too, sped upstairs.

When Alyosha came home from school we added up the score. It was twenty-four points. It could have been more had the boys not made such a racket. After all, there are some sixteen thousand kinds of sea fish.

We can extend our game further. Besides finding it in the house, we can find the sea at the factory, on the building site, in the fields, on the farm, on the shooting-ground, in the artist's studio and the scientist's laboratory.

People learned long ago to obtain magnesium, sulphur and bromine from sea water.

Seaweed yields alginic acid, which is used in making fabrics water-proof. A confectioner could not make the fruit jellies children like so much without agar-agar, a jelly prepared by boiling red algae. In China you might be treated to jam made from laminarian algae. Japanese cooks wrap the leaves of amori algae around minced meat to make rolls.

Seaweed makes good hay. Cows fed on sea hay yield more milk, and sheep grow wool faster than those fed on ordinary hay.

When the tiny algae called diatoms die they form the rock known as diatomite. This rock is added to cement.

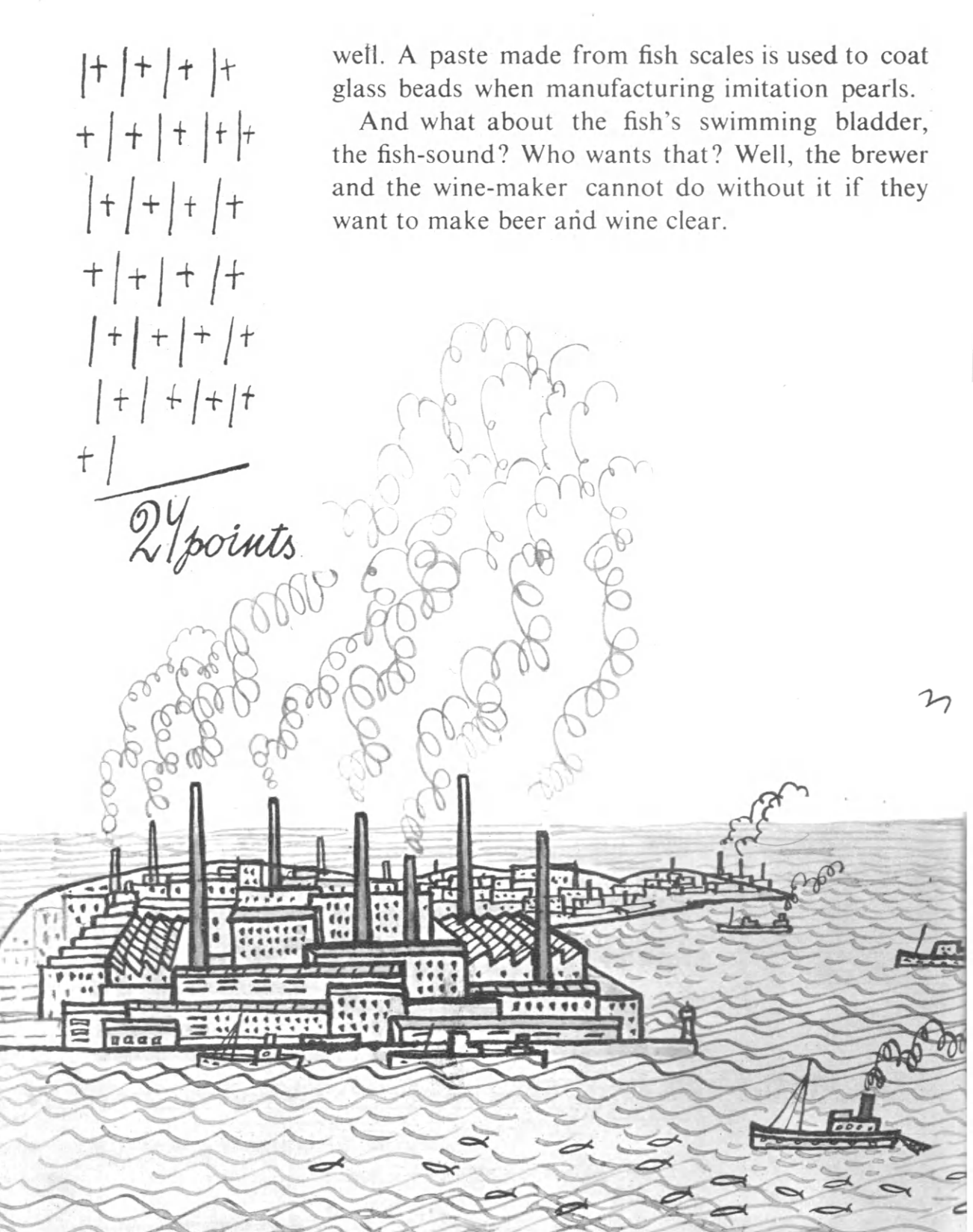
A paste made from algae is used if a metal surface has to be ground with particular precision.

Blubber goes into the making of soap, face cream, and oil paints. Nitroglycerine, the base of dynamite, is made from glycerine, also obtained from blubber. Ambergris, which lends stability to perfumes, is a wax-like substance found in the intestines of the sperm whale.

What about fish? They can be used from head to tail. The skin of the shark, the catfish and some other large fish makes sandals and other shoes, handbags and purses. Their bones are ground into meal which if added to the food of chickens and pigs makes them grow

well. A paste made from fish scales is used to coat glass beads when manufacturing imitation pearls.

And what about the fish's swimming bladder, the fish-sound? Who wants that? Well, the brewer and the wine-maker cannot do without it if they want to make beer and wine clear.



Even spoiled fish is not wasted. It is used as fertiliser.

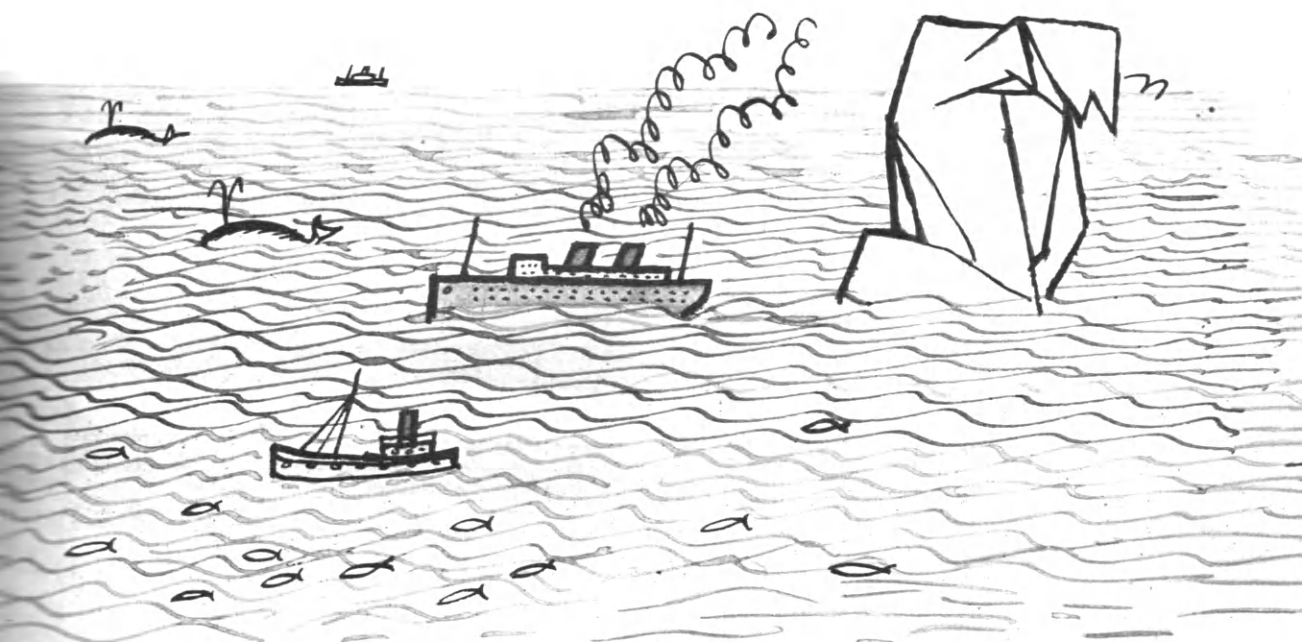
It is hard to list all the things that the sea gives to man.

The sea cools us. It also gives us warmth because water retains heat longer than dry land. When the land cools the sea warms it.

Clouds accumulate over the sea and condense over the land, watering our orchards and fields.

We carry goods by sea. We rest at the seaside. We grow healthier by breathing sea air and bathing in sea water. It was not by chance that the Artek health resort for Young Pioneers was built on the seashore.

"I want to go to Artek," said Alyosha with a deep sigh. "I want to badly. Oh, somebody's knocking on the door again. Perhaps the twins have found something else."



But this time it was an old woman knocking.

"Have you a complaint?" Alyosha asked her politely.

"Oh, no, my boy! I've been your neighbour across the landing for the last twenty years and nobody's ever done me any harm."

"So you're in the game? What have you got—fish, crabs, pearls?"

"It's potatoes, sonny. I'm making potato soup for supper. But I've run out of salt. Could you lend me some? I'm afraid to go to the shop after dark, I'm too old for that. But soup without salt is as tasteless as water."

"The sea in a spoon!" cried Alyosha. "The sea is everywhere where there's a grain of salt—in a spoonful of soup, in porridge, in any food! Granny, you score a point."

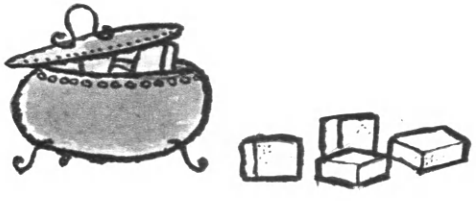
True enough. The sea flavours our food. How could we forget common salt, the simplest and most ordinary thing!

One up for Granny

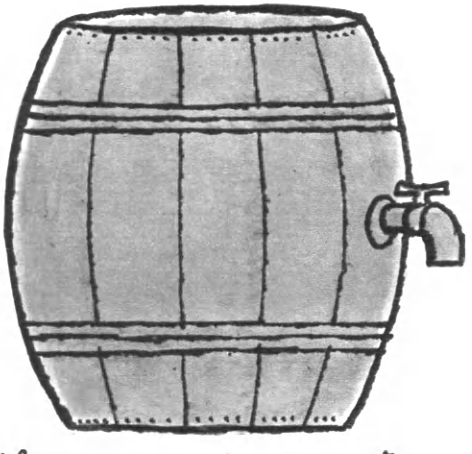
Our bodies contain different chemical substances, both simple and compound ones.

How much iron, for one thing, is there in the human body? Enough to make five or six small nails.

And sugar? Enough to fill a small sugar-bowl.



And water? A sizable barrelful, weighing more than half as much as man himself.



And there's more water than anything else!

Why should man carry so much water in him?

Because he cannot live without it. Any living body is composed of cells and the cells need water to live. Water carries nutrient substances. An animal that has spent all of its fat can live on, but most animals perish if they lose as little as one-tenth of the water in their bodies.

There is no life without water. In other words, where there is water there is life.

You may be familiar with the plant called the angelica. Boys make fine peashooters from its thick stem. Take a look at the footstalk of the leaf before you break off the stem. It is like a tiny boat. Rainwater lingers in it for a long time.

It is a hanging water tank no bigger than a teaspoon. But in spite of its small size it teems with infusorians, larvae, worms and like creatures.

And what about the moss that grows on a wall, roof or bare rock so long as there is a little water there?

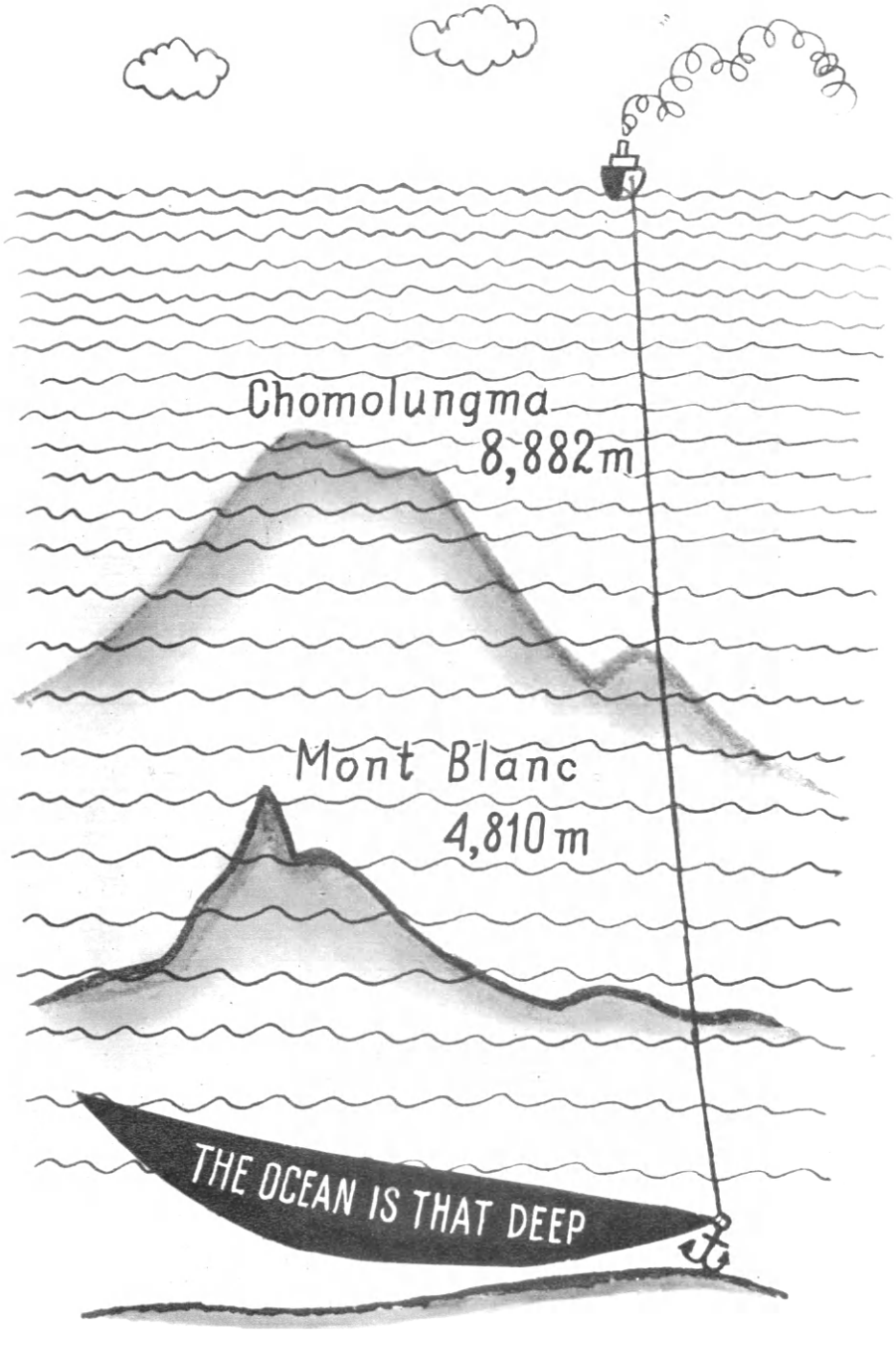
Have you ever heard of algae in an animal's hair?

That's hard to believe, isn't it? But it is true just the same. There are sloths in the humid tropical forests of South America. They spend all day hanging on a bough, head downwards. Green algae have been found in their long, moisture-laden hair.

Where there is water there is life. And where is water more plentiful that in the ocean?

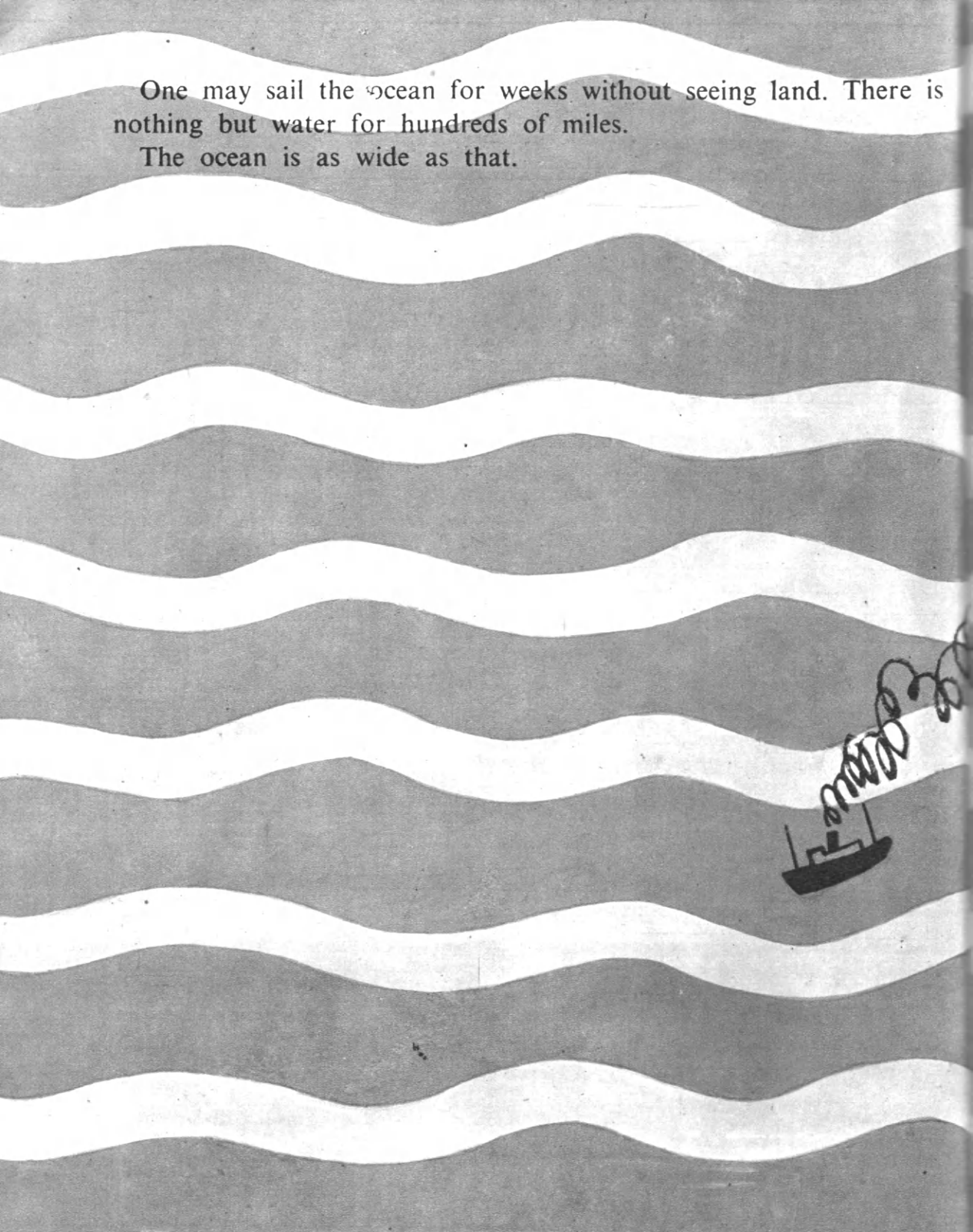
On the Chinese-Nepalese border rises Mt. Chomolungma (Everest). But this, the world's highest peak (8,882 m or 29,120 ft), is small compared with the ocean depths. In the Pacific Ocean a Soviet expedition on the *Vityaz* discovered a place 11,034 metres deep.

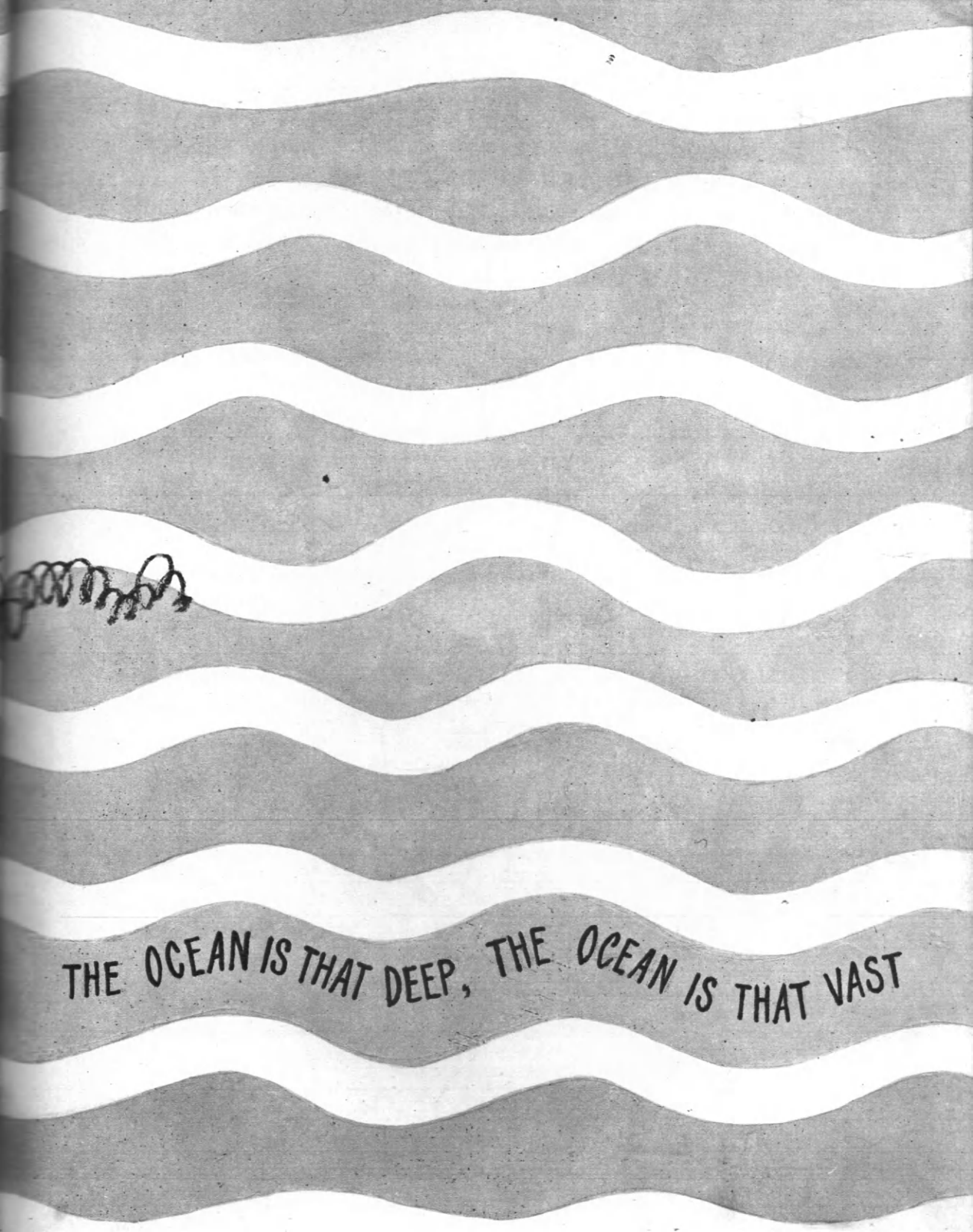
If Chomolungma were moved on to the ocean-floor, ships could sail over the spot without knowing it.


Chomolungma
8,882m
Mont Blanc
4,810m
THE OCEAN IS THAT DEEP

One may sail the ocean for weeks without seeing land. There is nothing but water for hundreds of miles.

The ocean is as wide as that.

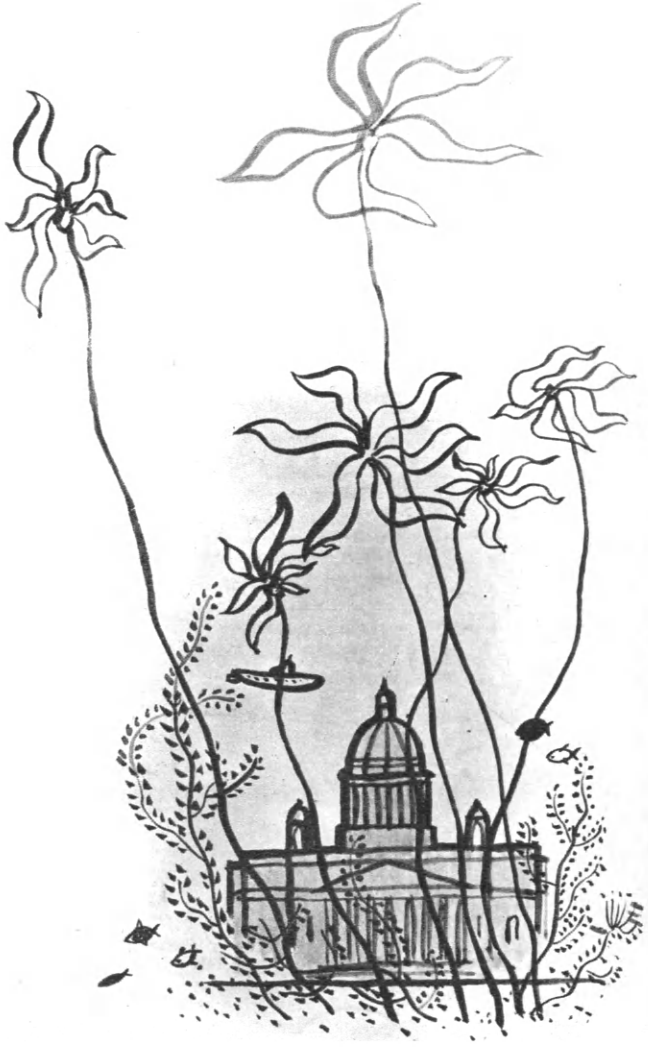


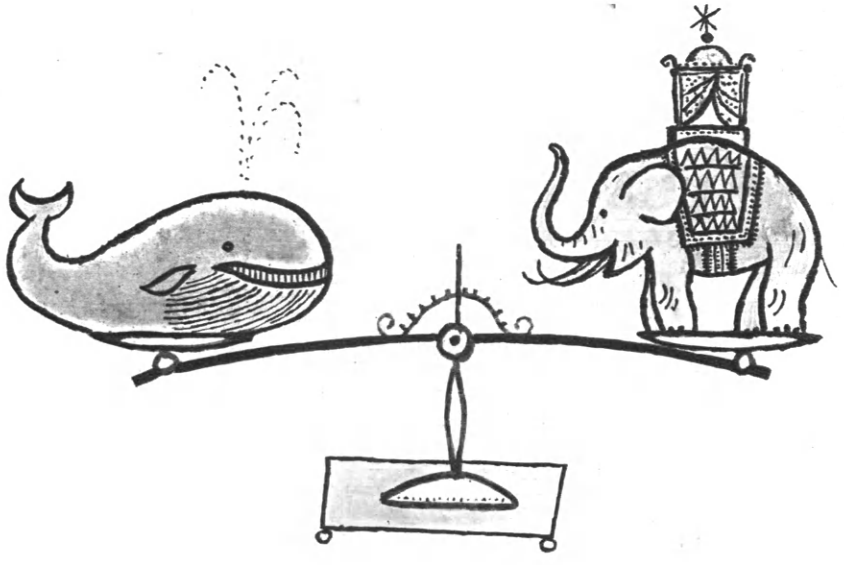

THE OCEAN IS THAT DEEP, THE OCEAN IS THAT VAST

But why do ships carry fresh water?

Think of hauling water over water, of storing up water when water is everywhere! Yes, there *is* plenty of water, but you cannot drink it because it is much too salty and bitter.

In that case, how can plants and animals live in such water? Well, they do and quite well, too. Nobody would grow to be a giant if his





environment were unsuitable. Dry land can boast no giants as big as those found in the sea.

If you straightened out the stem of the giant kelp, an alga, it would be two hundred metres long.

A midget submarine could become entangled in a growth of giant kelps, and a diver would seem like a dwarf in this undersea forest.

The elephant is the biggest of animals living on land. But put an elephant on one pan of the scales and a baby whale on the other and the sea baby will turn out to be heavier than the land giant.

A new-born blue whale weighs about five tons. But don't forget that it grows up. Every day it puts on a trifling one hundred kilograms, and grows by three to four centimetres.

Creatures grow fast in salt water. The salmon, on moving from a river to the sea, grows there in three years six times as big as it did in the three years it lived in the river. The smelt, which lives in the North

Sea, is three times as big as its fellow-smelt living in a lake. The tiny lake smelt even has a different name, whitebait.

The way from a river to the sea is open to all—any creature may go and settle in the sea. But none do. Nor do marine animals go into the rivers, for they have adapted themselves to life in salt water. Fresh water kills them.

In 1918 there was a downpour off the Australian coast where a coral reef extends for many miles, forming a huge submarine wall. It was in January, a winter month with us but a summer month in the southern hemisphere.

It rained cats and dogs for over a week.

The upper layer of the sea water freshened, and death began to rage. All fish, mollusks, corals, algae and sea-urchins to a depth of five to six metres disappeared. They died from fresh water.

CRAWLING LABORATORIES

But sometimes it is too much salt that brings trouble. The copepod, a small shellfish, is found in rocky sea-filled pools along some coasts, paddling gaily about in its stone bath tub.

Sometimes the level in the hollows sinks, and the water becomes as salty as a strong brine. The gay shellfish is no longer active but lies on the bottom in a torpor caused by excessive salt.

In the Gulf of Kara Boghaz, in the Caspian Sea, the water is so salty that it settles in crystals on the lake-bed. Fish cannot live there.

It follows that water with too much salt in it is bad too.

And what water is good?

Let the marine animals give the answer. Life in the oceans is more varied than anywhere else. On an average, the proportion of salts in 1 kilogram of ocean water is 35 grams.

However, it is not all common salt, or sodium chloride, as the chemists call it. Sea water is a solution of different salts, including those of potassium, calcium, iron, phosphorus, sulphur and other chemical elements. Sodium chloride is the most plentiful. It gives sea water its briny taste. The bitter taste comes from magnesium salts.

The ocean has been salty ever since it came into being. The sun has been shining on it for millions of years, evaporating the water but leaving the salts where they are. Cannot the oceans become concentrated like brine? No, in living memory the seas and oceans have become no saltier. The fact is that salts do not only accumulate in sea water but are used up too— marine inhabitants require lots of salt.

And what feeds on salts? Plants do. They, in their turn, feed animals.

That is one item of expenditure. But there is another, a greater one.

Plants need potassium to grow and develop, and animals need calcium to form their skeletons or to cover themselves with a protective shell.

See how helpless, how "bare", a mollusk becomes once its shell is removed. It can easily be devoured. But a shell cannot be swallowed—it would choke the eater. The shell is a fortress sheltering the mollusk from its enemies.

Construction of an amazing kind goes on under water. Builders there make their homes from, on or under themselves, taking the material from the water around them.

We still have no exact knowledge of how a mollusk builds its fortress. Perhaps it swallows the building material with its food. Or perhaps the building material penetrates the builder through its covering.

The Far Eastern oyster builds its home of calcium. But calcium salts are not plentiful in sea water. The oyster must use 770 litres of

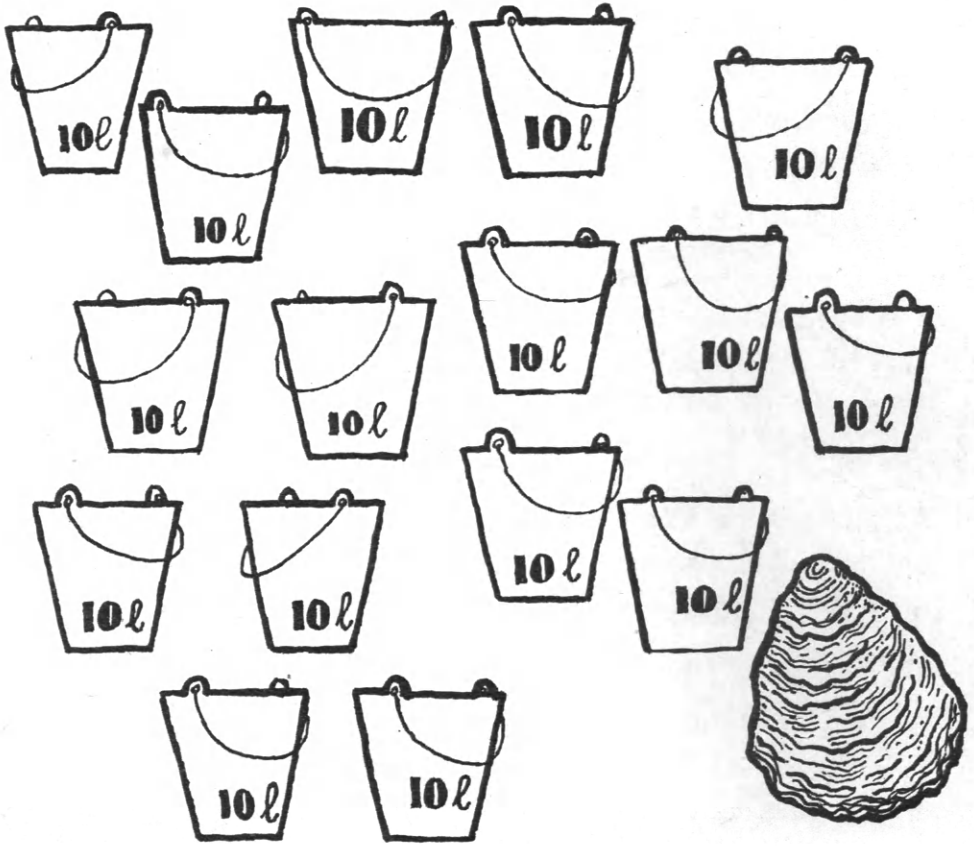
water, weighing 2,500 times as much as the builder itself, to make its home.

Calcium fills the nippers and shells of crabs and lobsters. A crab's nippers are so hard they cannot be smashed with a wooden club. It takes a hammer to do it.

Its solid shell is a reliable protection for the soft body of the crab.

But the owner of the shell grows. In a year's time its suit becomes too tight.

It must get a new suit and get it fast, or it will come to a sad end. It will soon be gobbled up no matter how carefully it hides itself among the rocks.



The crab changes clothes at top speed. In a few days it has a new shell ready, weighing almost half as much as itself.

The crab is its own chemical laboratory extracting calcium salts from sea water. There are countless living laboratories like this creeping, crawling, sitting, hanging or swimming in the oceans.

Marine inhabitants are veritable accumulators of calcium, silicon, phosphorus and iron. A silicious sponge contains one thousand times as much sea water as its own weight.

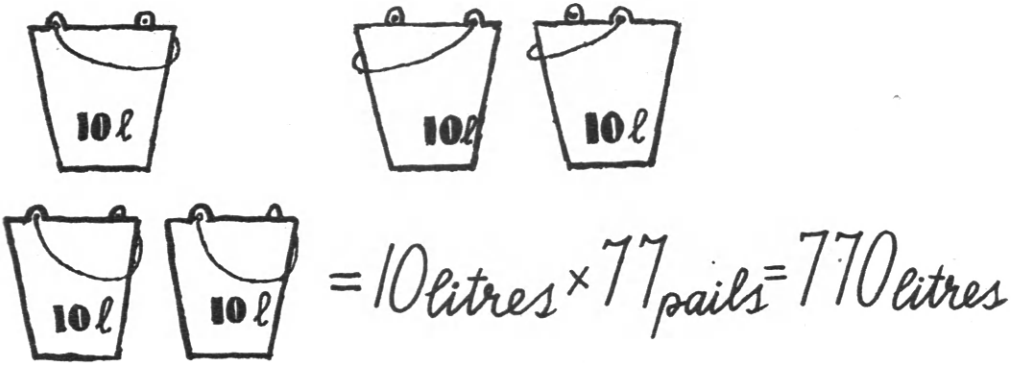
Some seaweeds contain so much lime that they feel as hard as rock.

Some inhabitants of the sea need phosphorus and others need magnesium. As for sodium, it is sought after least of all.

That is why sea water is so rich in common salt, or sodium chloride.

Salt can be got straight from the sea. But, of course, it has to be freed from impurities. It is generally obtained from salt lakes or from subterranean deposits of rock salt. Rock salt is the purer and can be used in food straight away. There are huge deposits of this kind of salt in the Urals and the Ukraine.

We may say that subterranean strata of rock salt lie where once a sea had been.



SEA QUIZ

After we had played "The Sea in the House", the boys and girls from all the five floors of our house looked on me as a friend. I was kept quite busy answering their greetings.

Some of them began to call on me. The twins, Oleg and Igor, came more often than the others. Occasionally they brought Kolya with them. They pretended they wanted to see Alyosha. And from Alyosha's they all came to me.

One day the two turned up although they knew very well that Alyosha was at school.

"Is Alyosha in?"

"No. You want something?"

"Please think up another sea game."

I gave the twins a sheet of paper. They sat at the table and wrote down my questions.

Let the boys and girls who read this book also try to answer the Sea Quiz between pages 80 and 81. The answers are on pages 167-70.

The twins read my questions, looked at each other and began to whisper.

"We must think," said Igor. "We can't answer them straight off."

But the twins did not have a chance to think long. Alyosha came home from school. He ran in without putting away his bag or taking off his overcoat.

"The sea in the classroom! Look!" he cried, and put a bit of ordinary chalk on the table.

THE SEA IN THE CLASSROOM

The teacher calls someone to the blackboard to do a sum. He comes out and picks up the chalk.

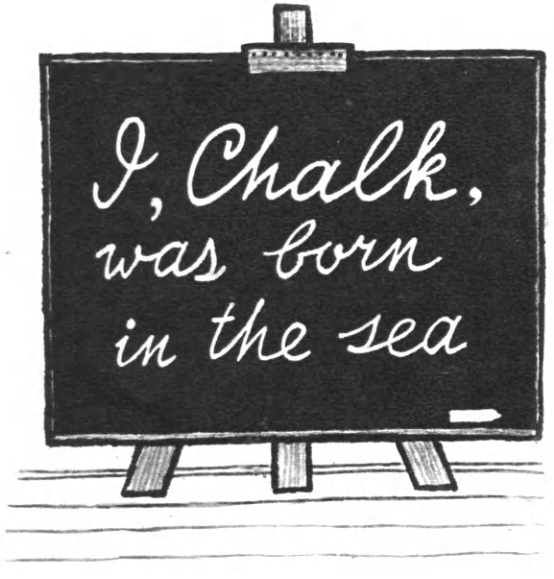
The chalk in his hand has a long story. It was brought from a chalk

quarry, where it had been broken off a white mountain. We have whole mountains of chalk. They are so white that they sparkle like snow in the sunlight.

Once a blue sea surged where those white mountains rise today. Millions of years ago that piece of chalk was a living creature drifting with the waves.

There are not only giant but minute weeds in the sea. A landing net of dense silk lowered into the sea will bring up nothing but mud. But it is very curious mud. It is a floating pasture, a multitude of minute plants without stems, leaves, or roots. They are like globules, threads, rods, flat cakes, horns and all sorts of flourishes. Each is composed of a single cell.

The largest plant in this floating pasture is only twice as large as a finger-nail. And the smallest cannot be seen with the naked eye but must be viewed through a microscope or a magnifying glass. The net cannot hold such a tiny weed. It sifts through the silk like dust.



A floating zoo of tiny marine animals drifts together with the floating pasture. These creatures live a restless life, just like the diminutive algae. They can swim only a short distance. But they are so small and light they cannot drown. They hover in the water as in wingless flight, and are borne along by the current.

Scientists call these involuntary seafarers *plankton*, which is Greek for "wandering".

The true colour of the ocean is blue, and many songs have been written about "the blue".

But seasoned seamen can also sing songs about brown seas, seas as green as grass, and seas as yellow as ripe lemons. Sometimes the ship's bow cuts through blood-red spots on the water.

Who paints the sea like that? Plankton.

At times some tiny weed multiplies in such numbers that it colours the water, changing its hue. Then the sea is flowering, seamen say.

But that is not why plankton is important. The life of every inhabitant of the ocean depends on these infinitesimal sea wanderers.

LILLIPUTIANS LEAD GIANTS

Here is a story: "One day a bull wanted to graze in a pasture. But the pasture ran away. The bull chased it. The harder the bull ran after it, the faster the pasture ran away." Could anybody believe such a story?

But what is a fairy tale on dry land is an ordinary thing in the sea.

Plankton is a floating pasture for the toothless whalebone whale. The sperm whale has some fifty teeth but they are useless for chewing. Even a toothed whale swallows its large-sized prey whole.

The blue whale has a mouth large enough to take in two school desks. But this whale feeds on small fishlets and, more important still, on plankton. Its toothless mouth is filled with horny plates by means of which it strains out plankton.

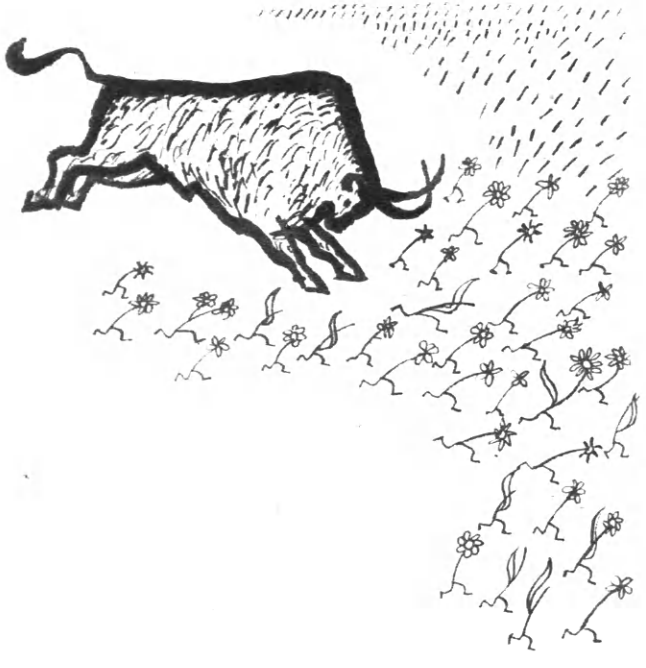
To get a satisfying meal, the blue whale must strain out several tons of plankton. Its stomach is a match for its owner—it is three metres long. This whale spends all its life chasing its restless pasture that moves about the sea in all directions.

Even night brings no rest to the sea wanderers. By day plankton goes down to escape the bright sunshine, but at night upwelling currents raise it to the surface again.

Plankton is most abundant in seas that are cold in winter and warm in summer. Whales "graze" in the Bering Sea in spring and summer. The Pomors, who live along the coast there, say that small shellfish —called krill—are the whales' favourite food. Where krill is plentiful the water turns pink.

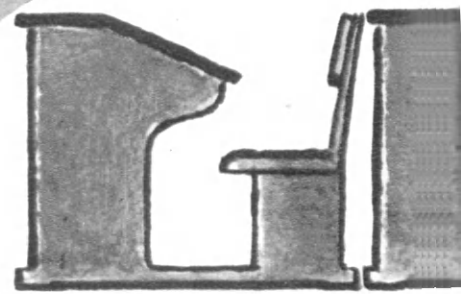
When winter comes animal and plant life in the Bering Sea diminishes. The whales go south to the tropics in search of food.

With the return of spring plankton again drifts in northern waters. And back come the whales to these grazing grounds once more pink with krill.



Whales of the Southern Hemisphere follow other routes. They spend the summer in Antarctica and the winter in the tropics.

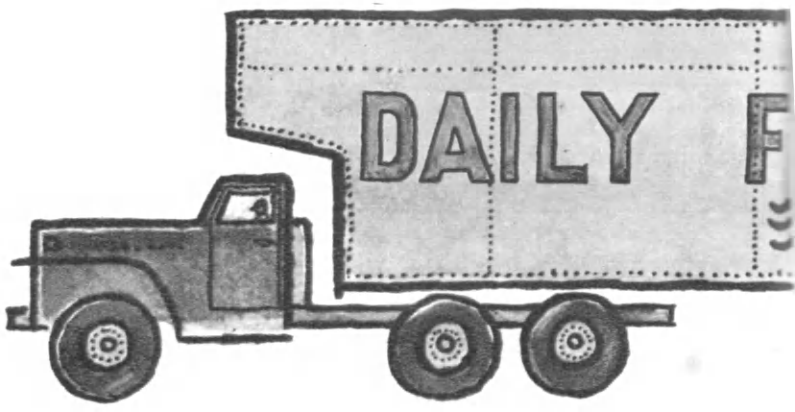
But in both hemispheres, plankton charts the routes of whales. Lilliputians lead giants.



THE OCEANIC LARDER

Plankton is not only a floating pasture for whales but a food supplier for the whole ocean. You don't believe it? Let us see who eats what.

Tiny weeds feed on the salts of the sea. They are eaten by plankton shellfish which in turn are eaten by small fish which are eaten by large marine predators.



It is like the links of a chain in which vegetable plankton is the first link. Only plants are capable of converting inorganic substances—salts, gases, carbon dioxide—into vegetable, or organic substances, which serve as food for animals.

If the improbable happened and all oceanic plankton perished, the fish would perish too, and all the predators in the sea would starve to death.

The more plankton in the sea, the more plentiful the fish. It is quite plain why hydrobiologists study plankton so carefully.

An agronomist who wants to test soil productivity scoops up a handful of earth. The hydrobiologist takes his sample from the sea with a silk landing net. The amount of plankton in it tells him how fertile the sea there is.

Sometimes people harvest from the sea what they sowed there. Soviet fish-farmers release young fish they have reared into the sea. But before doing this they make sure there will be plenty of food for the fry in the new waters. Who can take care of this but plankton, the food supplier of the ocean?

Plankton is also a vitamin factory.

Why is cod-liver oil so rich in vitamins? This can be found out, too, considering who eats what. Cod eat small fish called capelin, which eat plankton crustaceans, which eat tiny algae from the floating pasture, and algae abound in vitamins. The mystery is solved. Plankton gives us accurate information.

It is very important for captains cruising in the Arctic to know when the route is open and when and where the ice breaks up. Plankton, the tiny sea wanderers, supply this information too.

The wanderers do not live long. One-third of the plants in a floating pasture die every twenty-four hours and fall to the sea-floor. It is always "raining" in the dark depths of the ocean as dead plants and animals, big and small, sink slowly to the bottom. There they decompose. What plants and animals take from the ocean in their lifetime is restored to the ocean upon their death in the form of salts and gases. These salts serve as food for new tiny weeds, which are eaten by small shellfish which, in their turn, are preyed on by fish which eventually die and decompose, and the cycle recommences.

The sea gets back only what decays and dissolves in the water. Hard shells and skeletons remain on the bottom. Even the shell of the globigerina, a tiny marine creature, does not dissolve. These calcareous little shells and skeletons form globigerina ooze on the sea-floor.

This ooze piles up very slowly, at the rate of one millimetre in a thousand years.

At some point in time the face of the earth changed, the sea-floor rose, and globigerina deposits became the white mountains from which we take the chalk we need.

That is what we talked about the evening Alyosha brought the bit of chalk from school. It was my last evening in Leningrad. Next day I was leaving for Moscow.

The twins, Alyosha and Kolya walked with me to the tram stop. Kolya tried again and again to present me with a gold fish as a souvenir. It was all I could do to convince him that I would remember him anyway.

"Come back soon," said Alyosha. "We'll play some other sea game. Do you know a fifth is seeing you off?"

I looked round but saw no familiar face.

"You can't see it. It's the breeze that's seeing you off."

I FIND A MANUSCRIPT

It so happened that I went to Leningrad again, for the winter holidays. But this time I did not find my young friends in town.

Alyosha was staying with some relatives in the country. Oleg's and Igor's parents had moved, and the twins now lived in another district. My friends, the sea fans, had gone. But I still often thought of the sea. Perhaps because the sea and Leningrad are inseparable.

One evening as I was crossing a small public garden on my way home, my foot struck something which skimmed over the snow-covered walk. I bent down and picked up a package. It was a thick exercise book rolled up.

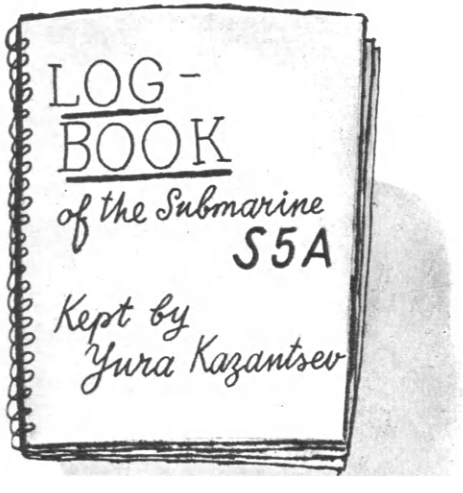
It was snowing. Fuzzy snow-stars fell slowly from the sky. I was white with snow but stood waiting, hoping that the loser of the package might come back. But nobody came.

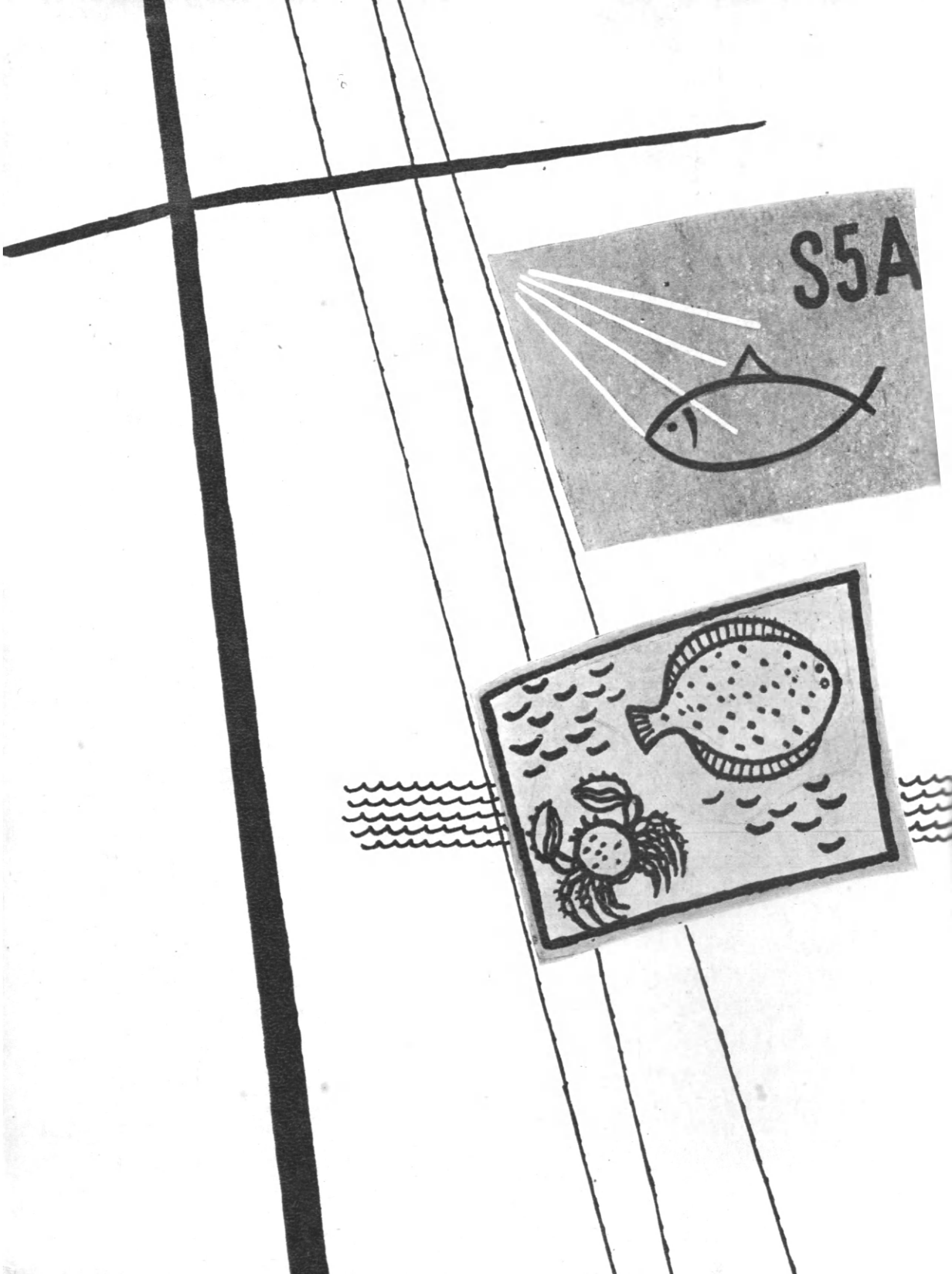
Back at home I unrolled my find to dry it. Written on its cover was:

"Logbook of the submarine S5A. Kept by Yura Kazantsev."

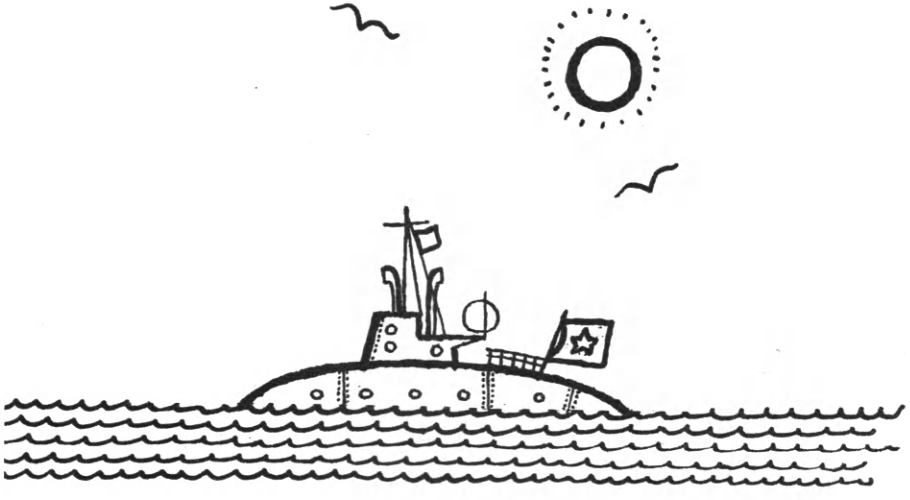
So that mysterious ship did exist after all. I wondered what Victor would have to say now. But before talking to him I would read the log.

Here it is




S5A

PART TWO



The SUBVIEWER puts to sea

Yura Kazantsev's Diary

THE CAPTAIN DREAMS OF RATS

"You lazybones!"

That was Slava Pyshkin shouting at me. I made no reply. There was nothing I could say. We've been in Vladivostok harbour since yesterday and Slava has become captain of the S5A. And you can't argue with your captain.

But why call me "lazybones"? Everybody has his job. The captain is charting our route: Sea of Japan—Sea of Okhotsk—Bering Sea—Pacific Ocean. Keepmum, Katya and Maya, our marine pathfinders, are letting off bubbles under water, testing their "frogman's" suits. And I am wireless operator. I keep a logbook. That's enough for me to do, isn't it? But no, the captain has another nice little job for me—he wants me to design the flag of the S5A.

Five A stands for our class at school. *S* is for *Subviewer*. That is the name of our ship. We're about to make a trip into the undersea world and watch life there. The *Subviewer* is a submarine of special design—we have no engineers, mechanics or sailors.

We don't have to start up engines to get the S5A going, because—oh, I almost let it out. Keep quiet, chatterbox! By decision of the whole

crew, it's forbidden to tell anything about the design of the *Subviewer* till the end of the voyage.

But the captain said that even the most mysterious ship must have a flag of her own. All right, she will.

I drew several slanting gold-coloured lines across a piece of silk as blue as the sea. It's meant to be a searchlight shining through the layers of water. Next I painted a fish caught in the beam of the searchlight, and in the upper right-hand corner I put "S5A". Perhaps my design is not the best but I have nobody to consult as three of our five-man crew are somewhere on the sea-floor just now. I must say that on the whole they aren't a bad lot.

Take Valera, nicknamed Keepmum. He doesn't say much but he makes a good job of everything he's told to do. There are two girls, Maya and Katya. Maya is serious and well-read. And Katya? She should have been a boy—she isn't afraid of anything and will knuckle under to nobody.

Now for the captain, Slava Pyshkin. He is fond of birds. He certainly can command, and we all obey him. It is true that he's a bit conceited and—I had no sooner thought of the captain than he appeared in person.

"Well done," he said, meaning the flag. "Aren't the 'frogs' back yet? Have they drowned or something?"

I was worried about the girls too. But like the sailor I was I didn't show it.

"They'll come back, all right," I answered calmly. "Frogs never drown."

"Yura--" Suddenly the captain's voice shook. "Last night I dreamed of rats. It's an evil omen. Don't you think we'd better give up this idea of a submarine voyage?"

"What do you mean, 'give up'? Why, it's so awfully interesting! We'll find ourselves in an entirely different world. Anton Petrovich told us that a body immersed in water is pushed upwards wich a

force equal to the weight of the water it has displaced, remember? Under water you become an athlete. You can lift a rock from the sea-floor you could never lift on land."

"I'm not going to do any weight-lifting under water," laughed Slava. "What do we want with the sea-floor, anyway! Why not go to the woods instead, where the birds sing? Under water everything is dumb. They just stare at you with their fish eyes and say nothing."

"Well, would you like a shark to say, 'Halloa, Slava!'" I taunted him.

"Lay off there! I'm in no mood for jokes. A different world! H'm. What if we get into a mess?"

"We have Anton Petrovich."

"He's busy and can't come on board often. If we get into a mess it's me, the captain, that'll have to pay for it."

"Look here, Slava," I burst out. "Don't you be too full of yourself. We'll all answer for whatever happens, understand? But if you're scared we'll find somebody else."

"I'm not scared at all," said Slava, in a different voice. "It's just that ever since that foolish dream I've had a feeling as if—"

He broke off and listened. Someone was coming down the corridor with hurried steps. The door opened and the "frogs" stood before us. All three looked embarrassed. A grey-mustached sailor we didn't know was with them.

"I'm Pavel Ivanovich," he said. "Which of you's the captain?"

"It's me," Slava whispered. "So it wasn't for nothing I saw those rats. I knew something was going to happen."

THE FROGMAN

But what really had happened? Keepmum and the two girls had gone in the boat to the mouth of the bay. Then they had cast lots. It had fallen to Katya to dive first.

"The girls are in luck," said Keepmum enviously. "But I'll dive right after them. You stay in the boat." He touched Maya on the shoulder—she was looking dreamily out to sea.

"A water globe," she said suddenly. "I remember when Daddy first showed me a globe. 'This is the earth we live on,' he said. 'The brown is land and the blue, water.' I spun the globe and said, 'Why do you call it "the earth"? You should call it "the ocean" because it's more than anything else.' Every schoolboy knows there's almost two and a half times as much blue as brown. But how few people have so far looked into the blue deep! And now we want—but own up you're a bit afraid, aren't you?"

Nobody answered. There was just the water lapping against the ship's side.

Why is it so difficult for man to make his way into the depths of the sea? Because although there is air in sea water man cannot breathe it into his lungs. It takes gills, such as fish have, to do that.

Fish breathe easily under water. But the whale, which breathes through its lungs, must surface for air. It is true that the whale has

huge lungs which can take in 14,000 litres of air at a time, or enough to last it an hour and a half.

But the store of air a human diver has in his lungs lasts him only one or two minutes. So take care, sponge and pearl divers! You'll never come back from the sea if you stay under longer than that.

But man is clever. He has thought of ways of prolonging his stay under water. He has invented the diving-suit. He walks about the sea-floor in it. On his feet he wears shoes with thick lead soles, and on his head a round metal helmet with a hose. The diver works on the sea-floor but breathes air from the surface supplied through a hose. Only he can't move farther away than the hose will let him. It holds him like a tether.

But nowadays he can travel unhampered under water, wearing trunks and an aqualung, he can swim where he likes. The aqualung consists of two cylinders filled with compressed air or oxygen. Two rubber tubes connect the cylinders with a mouthpiece.

He carries the cylinders on his back and keeps the mouthpiece in his mouth.

This kind of suit is worn by naturalists making collections on the sea-floor, by divers hunting sharks, marine scientists and sportsmen.

Katya was putting on the aqualung as if it were a satchel. Maya handed her the rubber mask, with its very thick eyeglass.

"Spit on the glass," Maya told her, "and rinse your mask in the water if you don't want the glass to get misted. And please, don't forget to blow bubbles."

Maya was right about the bubbles. The air which a frogman breathes out rises up in bubbles. The nearer to the surface, the larger they are. When those who watch from the boat see large, seething bubbles they know everything is all right.

"I shan't," laughed Katya. "Well, so long."

A splash. Two huge frog's feet—Katya's feet in rubber flippers—flashed above the water. Then the sea closed over them.

KATYA LOSES HER WAY

Katya had thought that the moment she got under water, sea monsters would crowd round her. But for the time being she was surrounded by a greenish haze. However, it was a special haze, one not seen on land. Spring, the season when the floating pastures bloom, was almost over. Plankton filled the water with a living green haze.

Some narrow silhouettes slipped noiselessly past. They were fish Katya had scared away from their feeding ground. Natives of the place, they easily recognised the landmarks. But Katya was a stranger there. And what befell her was what often happens to divers. Katya lost her bearings. She thought she was swimming out to sea while actually swimming shorewards.

She saw an oblong mass poised in the water. "An underwater cliff," Katya told herself. Varicoloured weeds swayed gently, as if to welcome her. The queer thing was that the shaggy cliff hovered above her like a dark cloud instead of resting on the bottom.

Katya had a collection bag with her. It was easy to tear off the green, brown and red algae. But the shells clinging to the cliff wouldn't give. Katya went on tugging at them until she felt herself being pulled along by one of the shells. But it wasn't the shell that was pulling her. The whole of the cliff was floating slowly along, trailing the weeds that grew on it.

With a desperate thrust Katya shot up to the surface. And although she was out of danger she screamed. Her scream brought people from the barge—the one whose barnacled bottom the inexperienced "frog-man" had mistaken for a cliff—hurrying to her aid.

Next a motorboat chugged up and Pavel Ivanovich, chief of the harbour, offered to take the sea pathfinders home.

"Now you know all about it," said Katya softly. "I did a poor job. But I collected a few specimens all the same."

"Let's see them," Slava demanded curtly.

He rummaged in Katya's bag.

"Trash," he announced. "And she screamed loud enough for everybody in the harbour to hear. We've made fools of ourselves on the very first day. I'll have to draft Katya out of the ship."

We gasped. It was no joking matter, drafting one out of a ship. But our visitor stood up for the poor "frogman".

"I'm sorry," he said, "I think it's the captain, first and foremost, who's answerable for the breach of public order in the harbour." He looked closely at the hushed Slava. "Besides, it isn't true that Katya's collection—by the way, I contributed a thing or two to it—is of no value to a seaman. I could tell you of an incident—"

"Please do!" cried the "frogmen", cheering up.

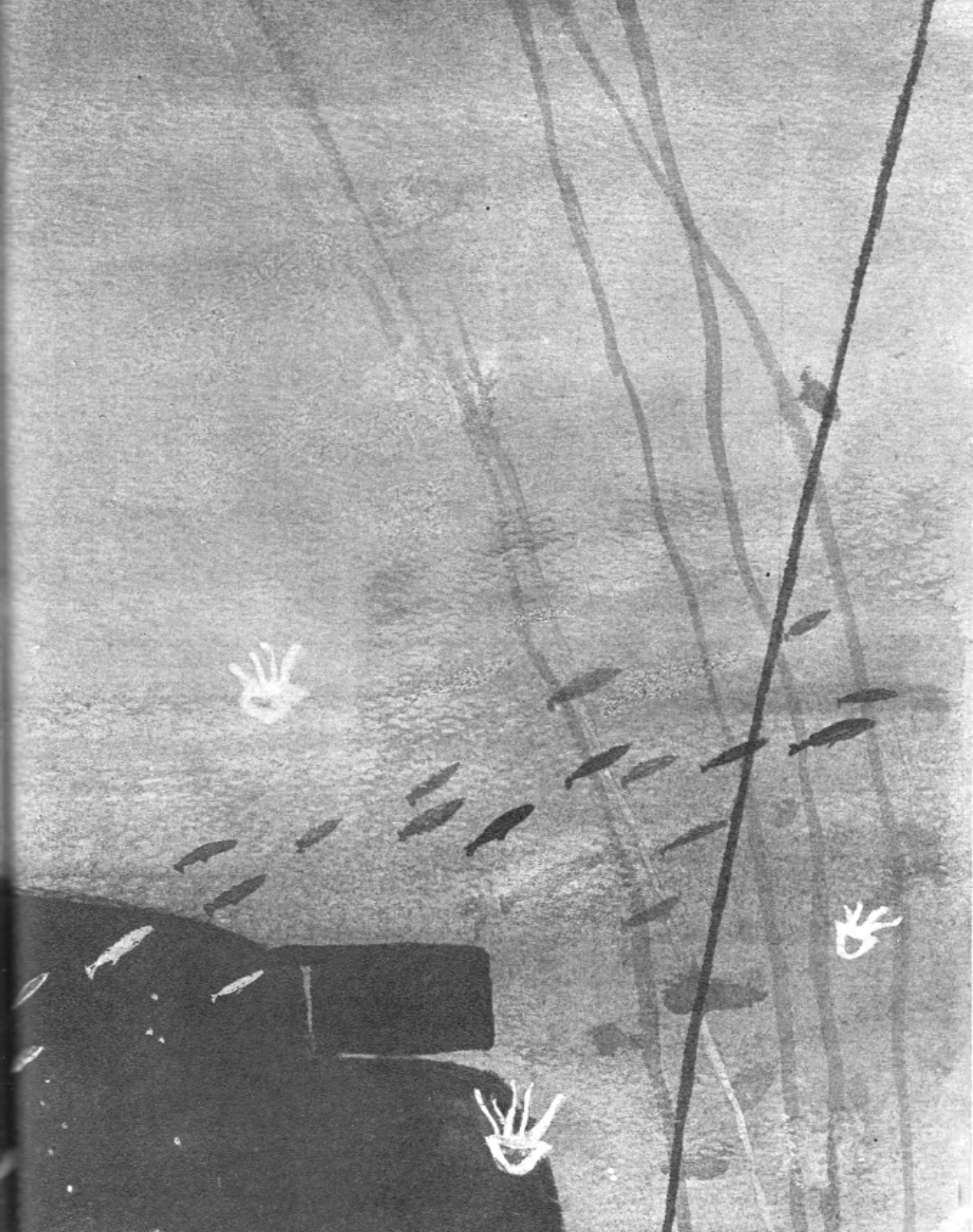
"Listen, then. It was during the First World War. Two British ships, the *Dartmouth* and *Bristol*, encountered the enemy—Austrian ships—in the Adriatic Sea. The flagship, *Dartmouth*, gave the *Bristol* the order: 'Follow me.' But what do you think happened? The *Bristol* began to drop astern. The Austrians took advantage of this. They attacked the solitary flagship.

"The flagship hoped that at any moment the *Bristol* would come to her aid. Minutes passed. Each one might have decided the outcome of the battle, but still there was no sign of the *Bristol*. Twenty minutes had gone by when they finally heard on the flagship a broadside from the *Bristol*, still a long way off.

"After the battle the captain of the *Bristol* was summoned on board the flagship.

" 'Is it a cruiser or a turtle you're in command of?' the Admiral asked him. 'You deserve to be court-martialled for failure to carry out orders! Anything you can say to clear yourself?'

" 'Say? No, sir,' the captain replied calmly. 'But I can *show* you something. Please have the bottom of the *Bristol* examined. That is my alibi.'



"It turned out that the cruiser's bottom was covered with 'stowaways'. That was why she had lost speed.

"Would you like to see those stowaways? Here they are."

Pavel Ivanovich emptied Katya's bag on to the table.

STOWAWAYS

We looked at the coiled tube worms, weeds and shells that cling to a ship's bottom. Wasn't there enough living space in the enormous expanses of the sea, we wondered? It looked as if there was not.

All marine inhabitants aren't wanderers, there are settlers as well. But where to settle? The sand is no good. Settlers on it would get washed away. A rock is a dependable anchor, but rocks are rather few in shallow waters. The canny Scots throw rocks into the sea. They sow rocks and reap sea hay, that is, seaweed. They feed it to their livestock.

Everything gets fouled in the sea—rocks and piles and wrecked ships. A hundred years ago a telegraph cable was raised from the sea-floor for repair. It was discovered that unbidden tenants—sponges, mollusks, worms—had made that uncomfortable place their home.

Ships are fouled too. Stowaways cling to them at anchor.

Warships ride at anchor for longer periods than traders and so are fouled more.

Marine stickers are so tenacious that even death cannot tear them off a ship. When a ship enters a river all stickers perish from the fresh water, but they don't come off the ship's bottom. Their friction on the water reduces the ship's speed.

True, nowadays warships are coated with a special paint to which no sticker can cling for long. But the best cure for stowaways is ultrasound. An ultrasonic vibrator is installed in the ship. When it is

switched on, all shells are flung off the ship's plating as if knocked off by little invisible hammers. The vibrator generates over twenty thousand oscillations per second.

In the future all ships will use wonderful hammers like that. Meanwhile stowaways continue to travel on ships, particularly freighters and barges.

We sat huddled round the table, looking at Katya's collection. We acquainted ourselves with sea lettuce, with its broad edible leaves; with red algae, phyllophores and corallines; tube worms which hide in their tube-like dwellings; and barnacles, which are among the toughest and most tenacious of stowaways.

Maya cautiously touched a blue-black shell and turned to Pavel Ivanovich.

"Isn't this a common mussel? I thought I recognised it. It's what the Irish Robinson Crusoe caught in his net."

"What?" Slava screwed up his eyes. "What Crusoe? You've probably never read *Robinson Crusoe*."

"Yes, I have. But I'm speaking of another one you've probably never read about."

Neither Slava nor, indeed, any one of us knew anything about the Irish Crusoe. Maya balked at first but in the end she told us the story of the mussel.

"The Irish Crusoe's name was Wilton," she said. "I call him 'Crusoe' because he found himself all alone on a deserted shore after a shipwreck off the west coast of France in 1235. He had neither a rifle nor supplies. What was he to do? He made a net from seaweed and strung it from some branches he'd stuck in the mud. He had hoped to catch a bird but he caught a slug instead. Next morning his net was covered with blue-black shells. He was starving, so he decided to try the mussels. They turned out to be delicious. Even today the French catch mussels by Irish Crusoe's method. Here in the Soviet Union, too, there are mussel farms. It's a very profitable

business. Six thousand kilograms of meat per hectare of sea can be harvested."

We enjoyed Maya's story. Pavel Ivanovich praised her too.

"You seem to be having a good time without my help," he said. "Besides, I must be going."

"No, we shan't let you go. Please tell us at least one more story!"

"All right—just one more. A trader returned to her home port in Germany after a run to faraway China. Neither the captain nor the crew noticed that the ship was carrying stowaways. Indeed, how could they have noticed them since they were hiding in the water tanks? As the ship was returning with empty holds, some ballast water was pumped into the tanks from a Chinese river to steady the ship and improve her draught. They didn't notice the crabs' larvae in the water. Those stowaways hid there throughout the home run and were pumped out into harbour with the water. The sea was foreign to them but they adapted themselves admirably to their new surroundings. Some ten years later German fishermen began to complain that crabs they had never known before were preying on the fish in their nets.

"You must be on the look-out," said Pavel Ivanovich in conclusion. "Yours is an unusual ship, of course, but you never can tell."

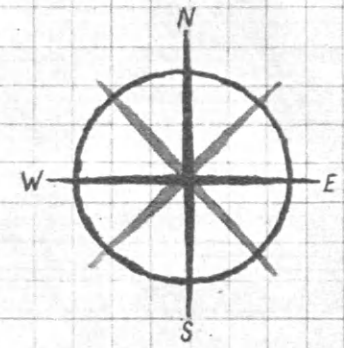
We saw our visitor off and I went to the messroom to see whether my flag had dried. There I bumped into Slava. He was sprawling on the floor, peering at something under the bookcase.

"Why, you clumsy bear!" he hissed angrily.

"What's the idea of lying on the floor?"

"I was investigating. What if a crab or a snake has got into our ship? It might bite us."

"I'll bite you if you talk such rot! A bookcase isn't a water tank, is it? That story about fouling at sea doesn't seem to have done you any good. We've been lying in harbour all of one day. You'd better look out the ship isn't fouled or she'll lose speed."



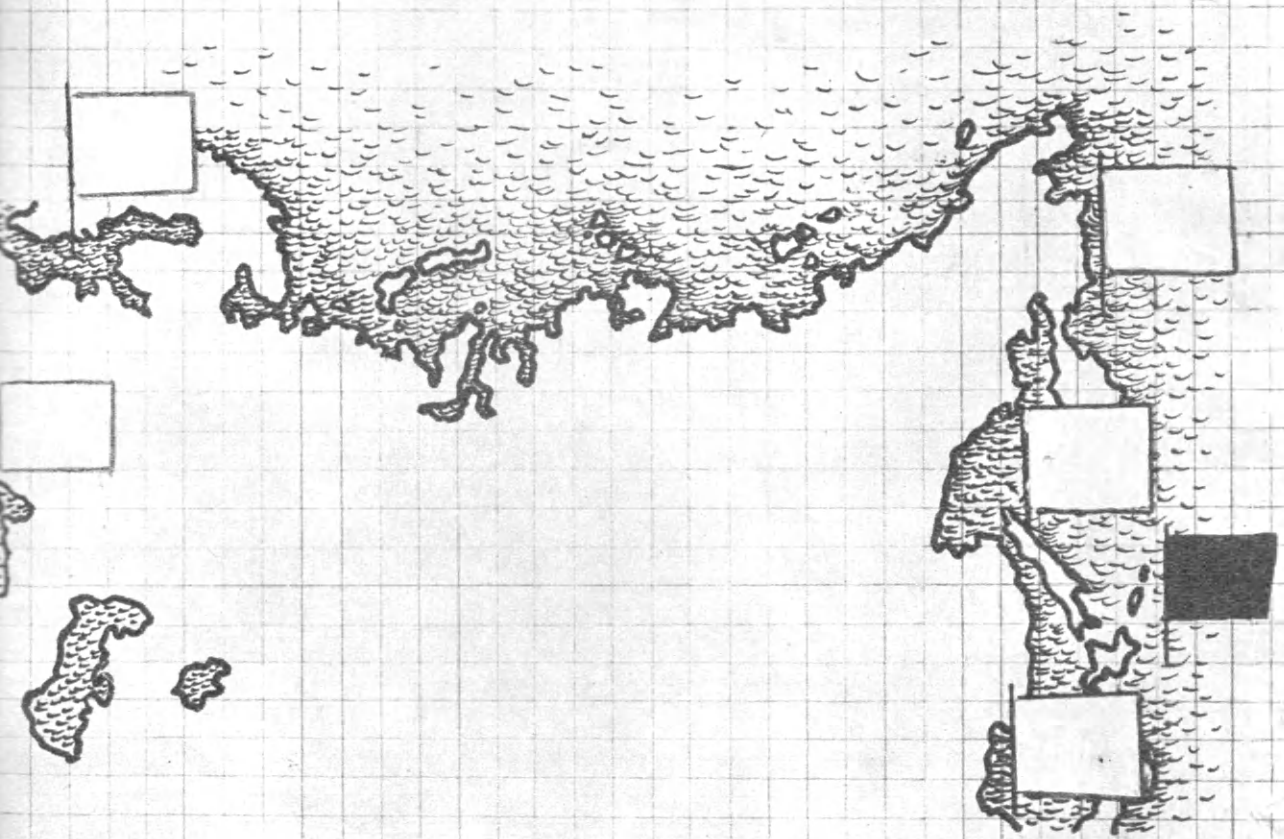
Slava stood up and dusted his knees.

"She won't," he said confidently. "We're sailing in ten minutes."

He crossed to the bookcase and took out a chart.

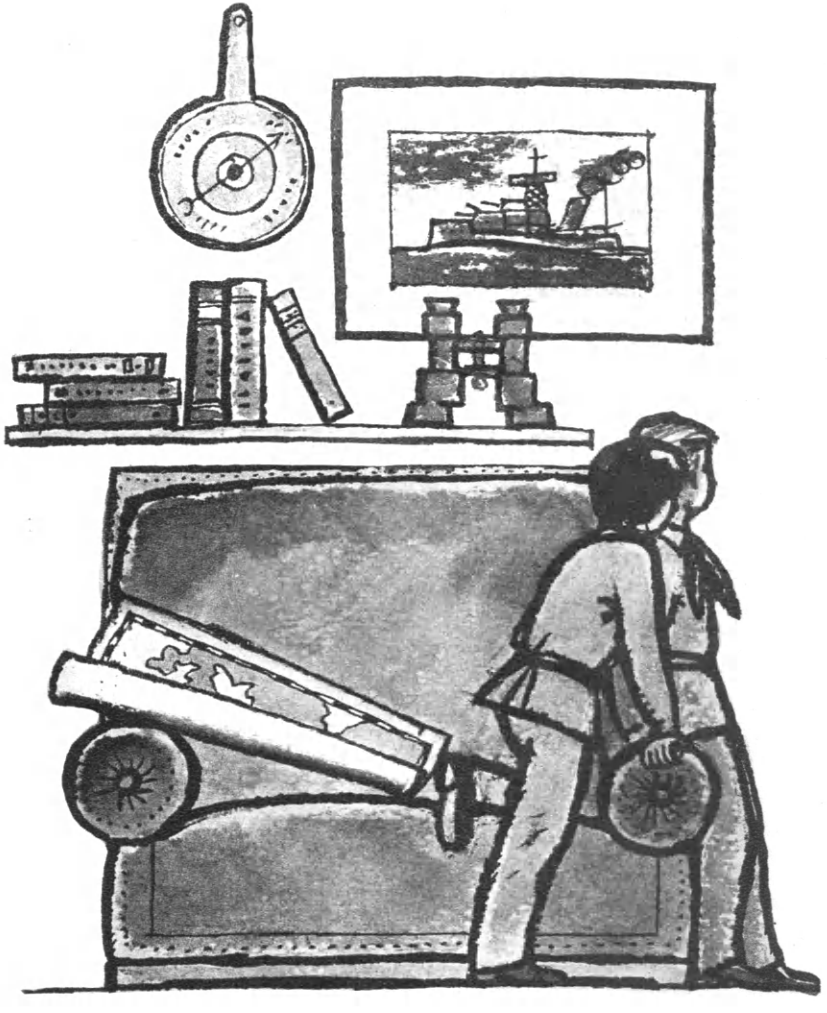
"Do you see these five white squares? They mark the places for the flags. We'll have a different flag for every sea we or our pathfinders explore. You're to design them."

I heaved a sigh. But orders are orders.

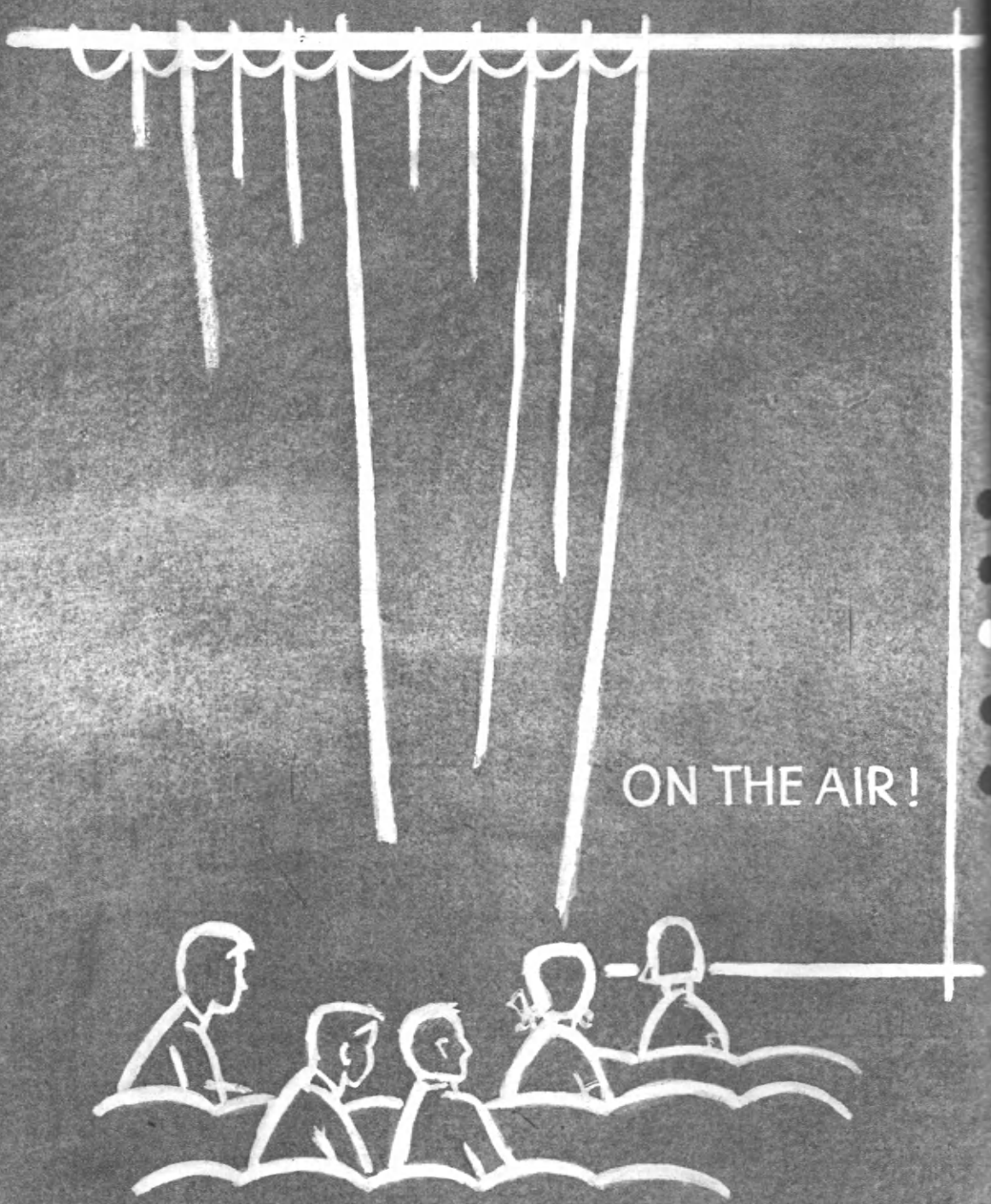


A DEEP-SEA TV SHOW

We are sailing in the Sea of Japan. A notice put up in the mess reads:




ATTENTION, PLEASE!
THE S5A TV STUDIO
BEGINS ITS TELECASTS
•
WATCH OUR
UNDERSEA PROGRAMME
OUR AUDIENCES WILL PLEASE
SUPPLY TITLES FOR OUR
TV FILMS
PRIZES WILL BE AWARDED
FOR THE BEST TITLES
OUR TEMPORARY ADDRESS:
SEA OF JAPAN


ON THE AIR !

It was all Anton Petrovich's idea.

"Remember," he told us, "deep-sea actors won't 'sit' long for their portraits. Some of them will just flit by. If you manage to recognise an actor and think of an apt title for your film, you'll get a prize."

Anton Petrovich offered to hold the first deep-sea show. We asked him to show us the sea-floor in shallow waters, where the actors move slowly and we could watch them longer.

The first thing we saw on the TV screen was what seemed like a huge golden-pink dahlia that had just opened. But when a careless little fish swam up to the fleshy petals they quivered and closed firmly on it.

"An actinian!" we gasped.

We had recognised the actinian, a flower-like marine animal, from its predatory behaviour. We thought we'd be able to watch it for a long time because actinians cannot get about quickly.

But we were disappointed. The "actor" suddenly moved into the background. Only it wasn't leaving the scene of its own accord—something was carrying it away. We had just time to see the marine hauler. It was a hermit crab, which had shouldered the burden of its own free will.

There is a big choice of houses without masters that is empty shells, on the sea bottom. The hermit crab crawls into one of them. It has no reliable armour of its own but must shelter in others' shells, which it carries along wherever it goes.

Using its claws, it carefully hoisted the actinian on to the roof of its own house where it rose like a tower, its stinging tentacles spread out, making the crab's dwelling an impregnable fortress.

"What title shall we give this film, children?" asked Anton Petrovich.

"*The Sea Hauler! The Actinian's Horse! Riding a Crab! The Sea Rider!*" came the replies.

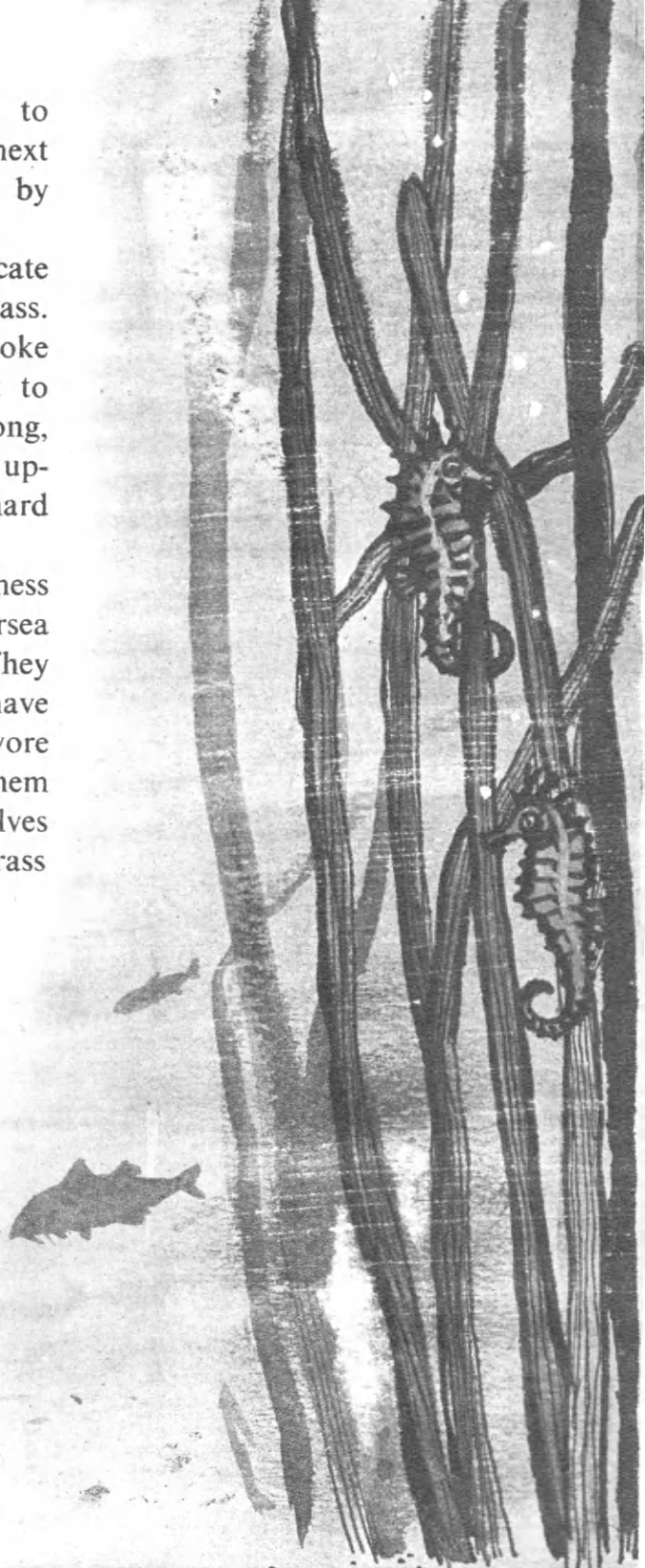
Anton Petrovich taught us to operate the TV set, and next day we held a deep-sea show by ourselves.

On the screen we saw the delicate green of a clump of sea grass. Suddenly one of the stalks broke and swam away. It turned out to be a pipefish—a creature with a long, narrow body. When it stands upright near sea grass stalks, it's hard to tell the fish from the grass.

Strange creatures shaped like chess knights were grazing in the undersea meadow. They were sea horses. They swim slowly because they have nobody to fear—no sea carnivore will eat them. We also saw them hitched—they hitch themselves by curling their tail round a grass stalk.

We had a good laugh when two sea horses hitched themselves together and started to pull each other in opposite directions.

We thought of many titles for the film, including *Undersea Meadow* *Sea Prairie* and *False*



Grass. We thought of titles for all our deep-sea films, except one. An unfamiliar small bluish-grey fish with five stripes caught our eye every now and then. It seemed to be accompanying the ship. But what sort of fish was it? What did it want with us?

"Shall we call the film *The Mysterious Stranger*?" Slava suggested.

"A title prompted by ignorance!" replied Katya, and everybody laughed.

The captain said no more, and nobody else suggested a title for the film.

THE SHARK'S FELLOW-TRAVELLER

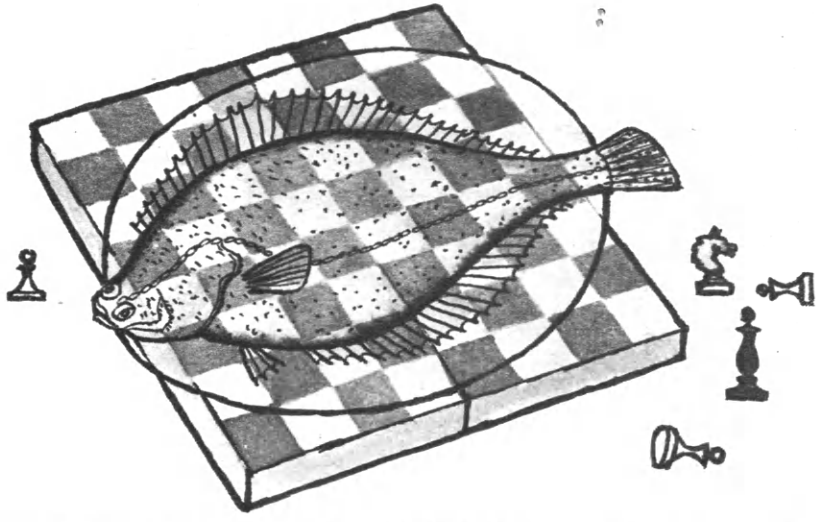
I was carried away by deep-sea television and neglected my work. And yet it was a wonderful idea, the one about flying in the mess and the wireless cabin a special flag for every sea we sailed in. Our first flag, that of the Sea of Japan, wasn't ready yet.

The fish population of the Sea of Japan is more varied than that of other seas. There are even tropical fish there. But you cannot put them all on one flag. A plaice and crab on a greenish ground would be enough.

I managed to draw the crab but couldn't do the plaice. So Keep-mum brought me a live one on a glass tray filled with water.

"It'll be your model," he said, and slipped out.

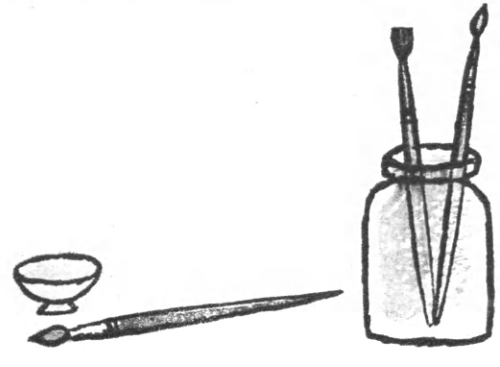
I mixed the colours. Then I glanced at my model and started. The tray was empty. Through the glass I could see the black and white



squares of the chessboard on which I had put the tray. Where was the plaice?

Only when I bent over the tray did I discover that the plaice had no intention of disappearing. It lay on the tray as before, except that its skin was now patterned like the chessboard. That's what I call camouflage!

I gave a sigh of relief. Chewing the tip of the brush, I wondered whether I should paint the plaice on its eyed or eyeless side. This queer fish's eye shifts as the fish grows. A young plaice, like any other fish, has an eye on each side of its body. But the plaice spends a lot of time lying on one side, in wait for its prey. It has no use for an eye on the underside. Indeed, what could that eye see but sand?



The young plaice undergoes the change which is typical of its whole kin. It adapts itself to lying on the bottom. Its body flattens, its skull-bones curve, and both of its eyes grow on one side.

I decided to paint the eyed side of the fish and dipped my brush into the black paint. But just then Maya rushed in.

"I got a prize!" she cried.

"The film we couldn't think up a name for will be entitled *The Shark's Guide*. I wonder why I didn't guess earlier that the mysterious stranger is the fish that is always hanging about the shark's snout—the pilot fish."

"Your pilot's been reduced to the ranks," I said. "People have come to know sharks better since the aqualung was invented. Nobody thinks any longer that the shark has a poor eyesight and that the pilot fish guides it."

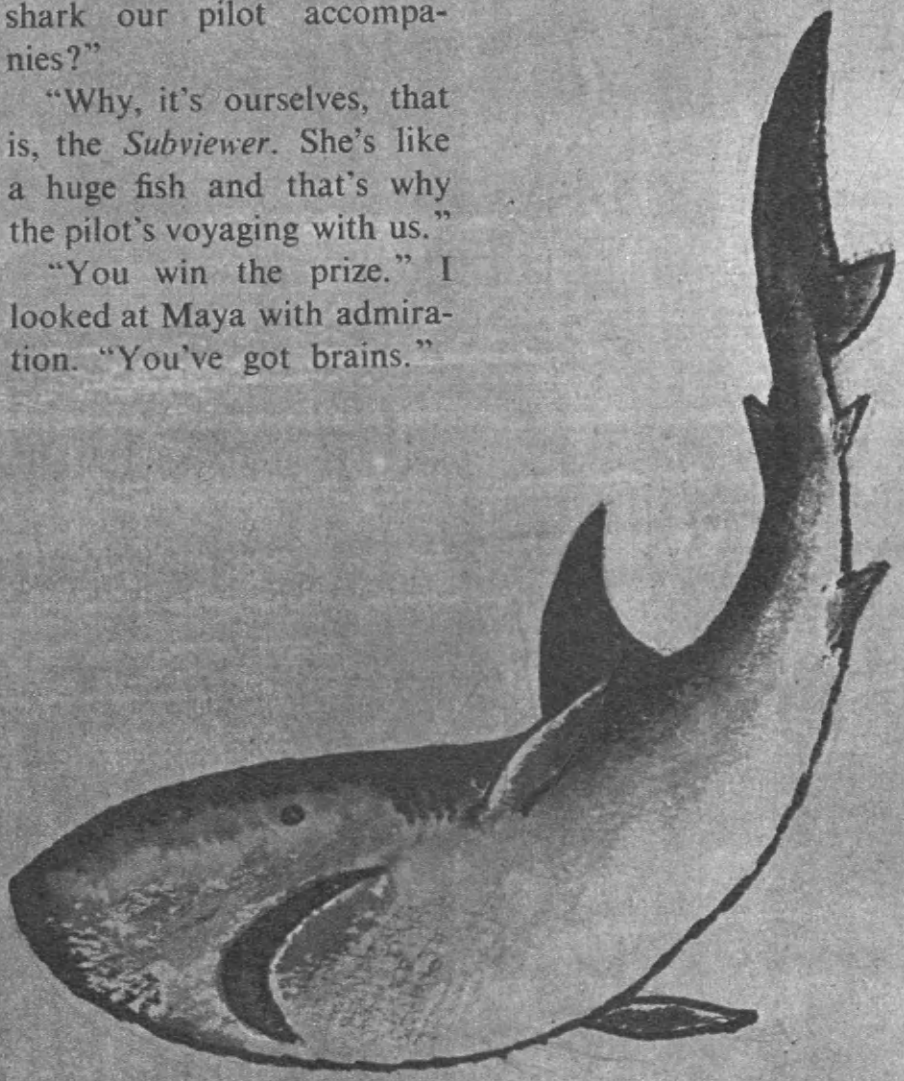
"All right," Maya agreed. "Here's another title: *The Shark's Fellow-Traveller*. The pilot accompanies the shark everywhere. It needs the shark even if the shark doesn't need it. The water layer which the shark puts in motion with its body pushes the pilot along, making

swimming easier for it. But the pilot's chief gain is that it picks up the leavings from the shark's meals. Do you agree to the title *The Shark's Fellow-Traveller*?"

"Yes, but where is the shark our pilot accompanies?"

"Why, it's ourselves, that is, the *Subviewer*. She's like a huge fish and that's why the pilot's voyaging with us."

"You win the prize." I looked at Maya with admiration. "You've got brains."

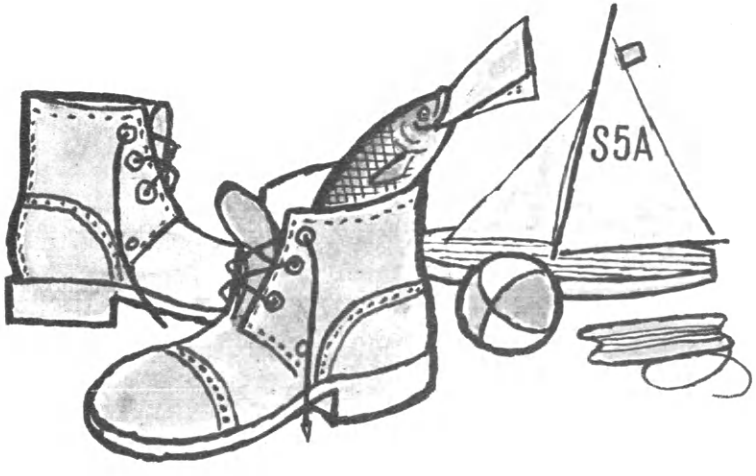


She laughed and ran out, and I picked up the brush. While I painted the plaice I kept thinking of the pilot. It has mistaken us for a shark, the fool!

STORIES TOLD BY A FISH'S SCALES

Next morning I recalled the pilot the moment I woke up. Was it still around or had it fallen behind? I must dress quickly. Perhaps the others had already turned on our deep-sea TV set.

Finding my shoes in the morning is a most difficult thing for me. I can never remember where I left them the night before.



This time my shoes were placed neatly under my bed but there was a fish's head poking out of one of them.

I peered at it. There was nothing terrible about it—it was just an ordinary herring. Only, it had a note sticking out of its mouth. I spread out the note, which was folded in a triangle, and read:

Tell me, please,
how old I am.

Then four lines underneath:

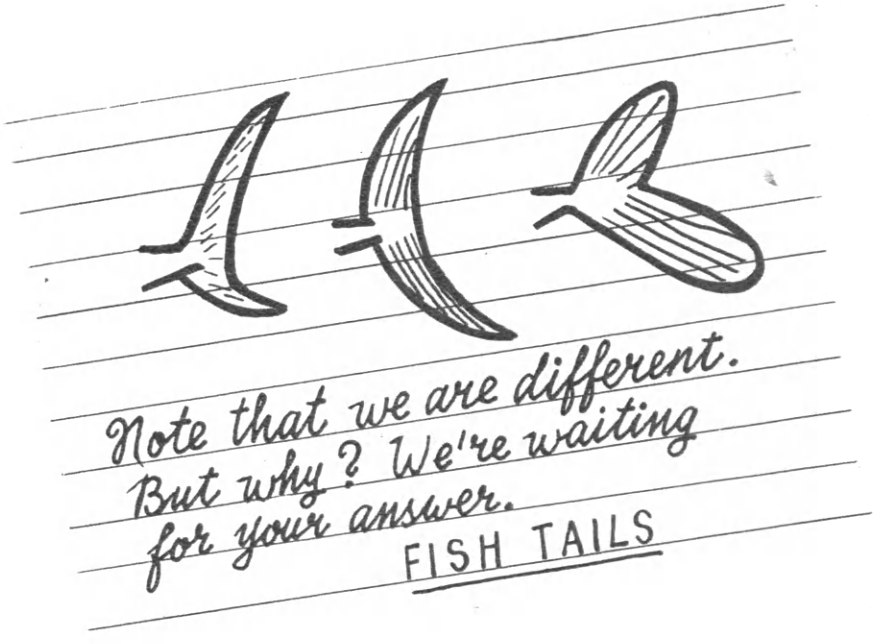
Sent at the request
of the Pacific herring
by the INVISIBLE

Having to deal with the invisible was too much. But don't worry, I'll find out who's pulling my leg. I heard footsteps in the passage. I rushed out and barred Katya's way.

"Where are you going in such a hurry, Miss Invisible One?"

"Why, I thought you were the Invisible One." Katya looked at me distrustfully. "Wasn't it you who drew these fish tails?" She held out a note she had received from the mysterious Invisible One.

There were three fish's tails drawn on the slip of paper, with the following message:



"This isn't so bad. Maya's got something much worse," said Katya with a sigh. "Her correspondent is a sea snake which asks her why snakes have been unable to take possession of the sea even though they have tried hard."

We hurried to Keepmum. The Invisible One had slipped a note under his door from a certain fish which wanted to know in what man had followed its example.

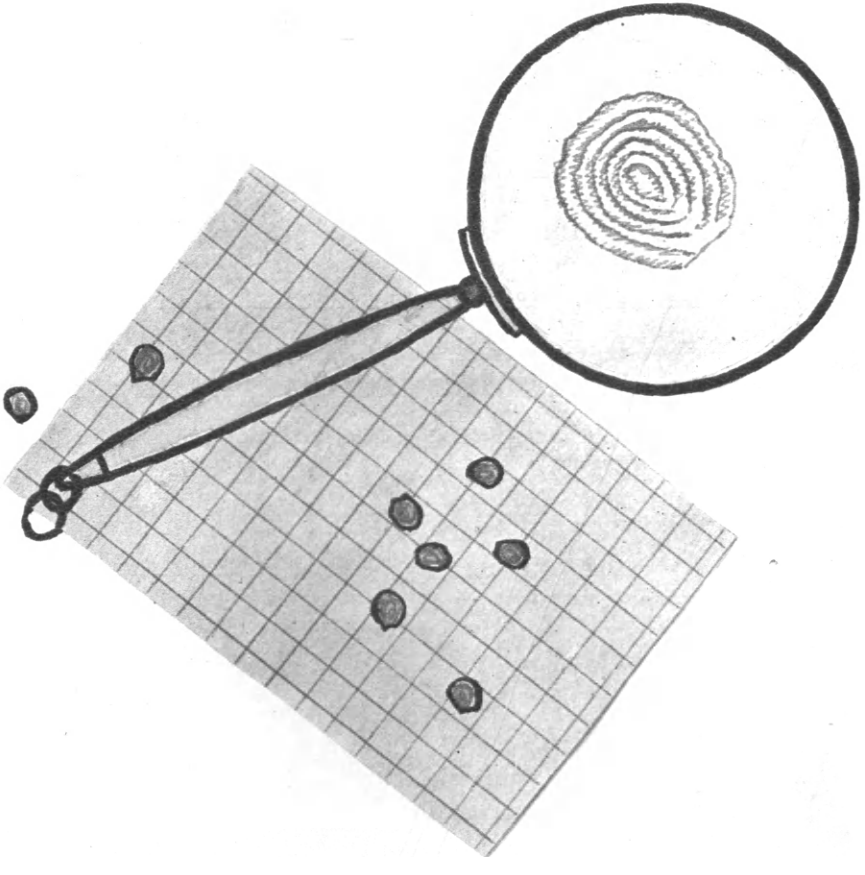
We roused the captain. As he was sleepy, it took him some time to realise that the pilot fish had accorded him the honour of starting a correspondence with him.

"*Watch me, I can be of service to you,*" the pilot fish had assured him. "*You have other helpers in air and water. Who are they?*"

Our suspicions now fell on Anton Petrovich. But he had left the ship the day before while the notes had been slipped in either during the night or in the morning.

So there was a stranger on board? Slava and Katya argued themselves hoarse about it. Maya tried to calm them. Only Keepmum, who stood by the porthole, was busy as usual doing something. I crossed to him and saw that he was examining the scales of my herring through a magnifying glass.

"What's so interesting about them? Let me take a look." I peered through the glass.



Each scale showed ring-shaped stripes alternating from broad to narrow and from light to dark. As I looked at them I recalled a summer day in the woods when we had learned to read the age of trees.

"We're in a forest reading-room now," our Young Pioneer leader had told us after lining us up near a stump. "From the rings on the stump you can learn how many years a tree has lived and whether those years were dry or rainy."

And now I saw rings on a fish scale. Was it possible to learn from them something about the fish's life, to make the scale "talk"?

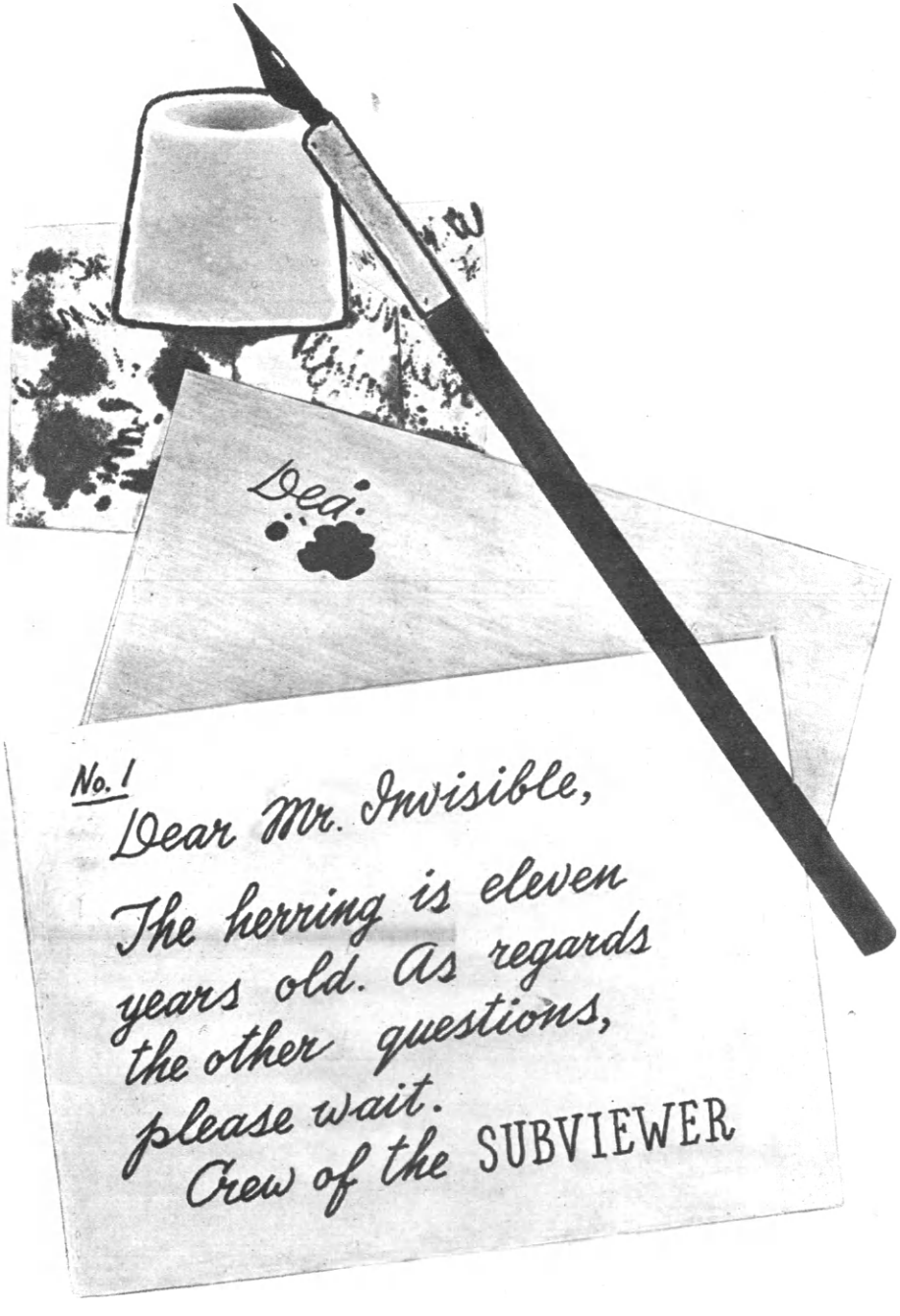
After we had consulted some books the scale did "talk". It told us quite a story.

A fish's body is covered all over with thin, supple scales. The bigger the fish, the faster its scales grow. They grow differently at different seasons—the growth is slower in winter than in spring and summer, and the scales are infused with lime less. It is easy to distinguish between the narrow, translucent winter stripe and the summer stripe. A fish is as old as the number of winter rings on its scales shows. But there is something more. The scales tell us how long the fish lived in a river before going to the sea. River rings are narrower than sea rings.

But the story of the scales doesn't end there. The fish starts on a long and difficult journey to spawn, to deposit roe. On the way it starves. The edges of its scales get thin, wear off or become scarred. You can tell by these scars how many times the fish has spawned.

A fish's scales tell a lot if only one knows how to ask them questions.

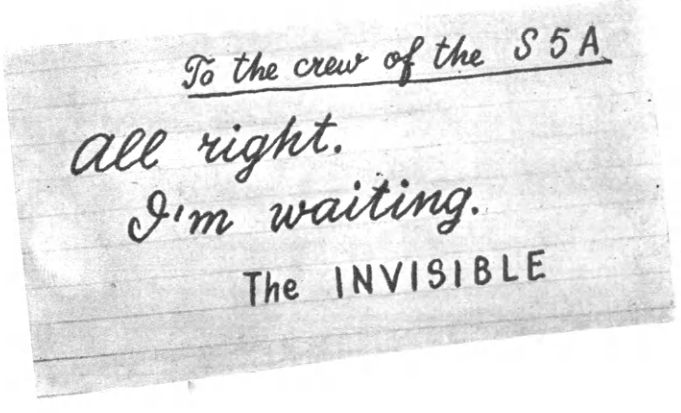
We had guessed one of the riddles. We got together in the mess and wrote our first answer.


Dear
No. 1
Dear Mr. Invisible,
The herring is eleven
years old. As regards
the other questions,
please wait.
Crew of the SUBVIEWER

We left it on the table for anybody to see. If the answer came together with Anton Petrovich, that would mean he was the Invisible One. That was my idea. Bright, wasn't it?

I dropped into the mess an hour later. A note still lay on the table. But I saw at once that it wasn't ours. The paper we had written on was checked and this was lined.

I bent down and read:

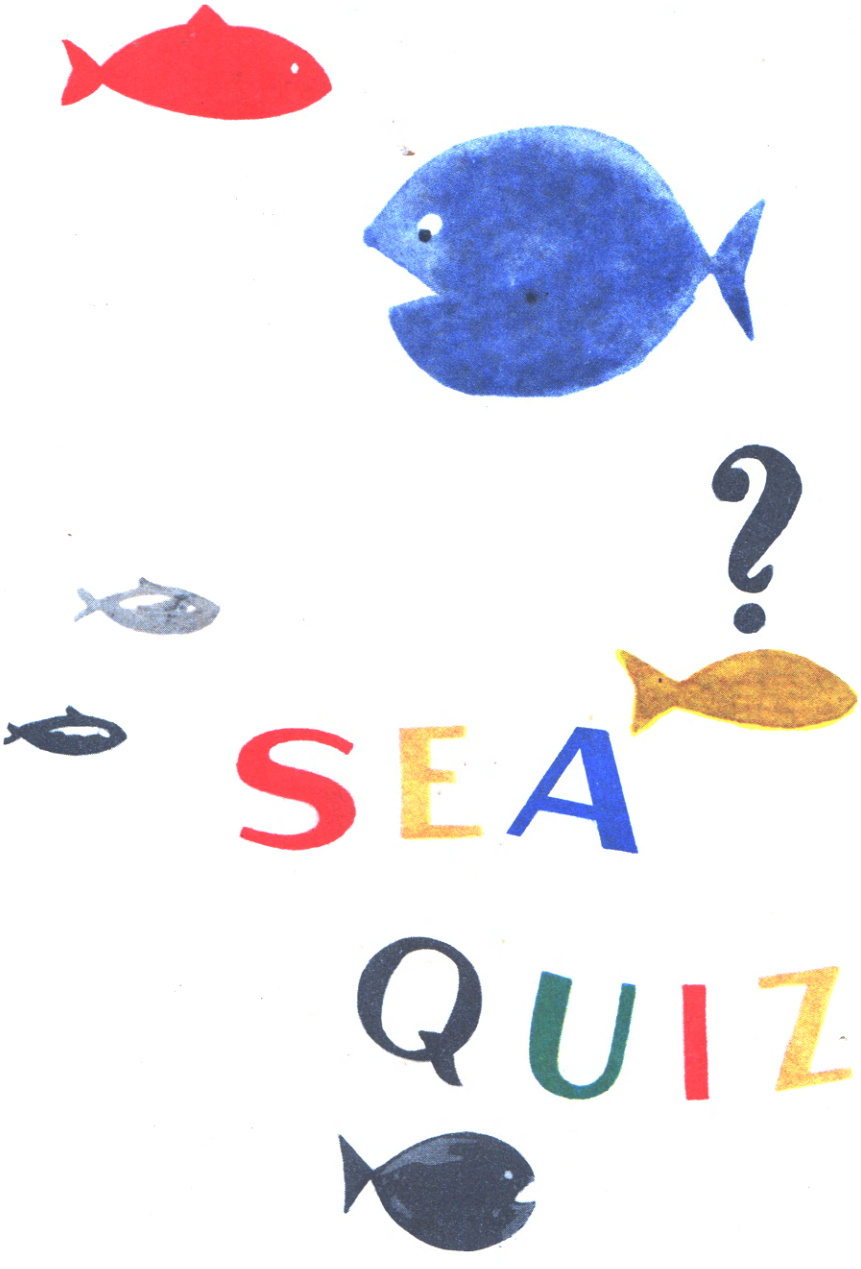


So the Invisible One wasn't Anton Petrovich but somebody else. But who?

FOUR HUNTERS DIVE INTO THE SEA

A gate on the beach bore the sign: "Deep-Sea Recreation Park". At the entrance aqualungs, masks with a breathing tube and flippers could be obtained; everything necessary for a dive into the park.

It's unwise to come late on a Sunday, for there are many visitors. It is nice and cool down there. The main walk is adorned with a bed


SEA
QUIZ

1.

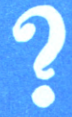
WHICH SEA IS THE SALTIEST?

2.

WHICH SEA IS THE WARMEST?

3.

WHICH SEA IS THE DEEPEST?



4.

WHICH SEA IS THE SHALLOWEST?

5.

WHICH SEA IS THE BLUEST?

6.

WHO HAS BOTH EYES ON ONE SIDE?

?

7.

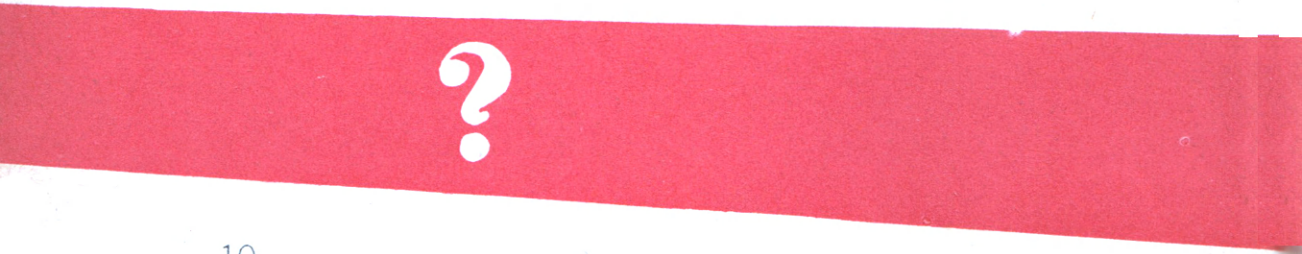
WHO HAS HIS MOUTH ON HIS BELLY?

8.

WHO HAS HIS TEETH IN HIS STOMACH?

9.

WHO HAS HIS STOMACH IN HIS LEGS?

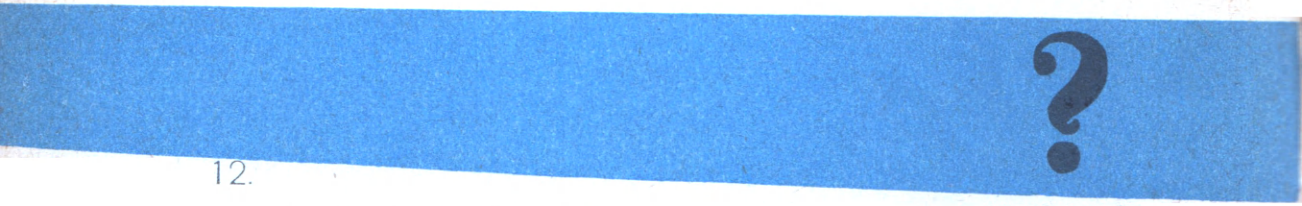


10.

WHO MOVES HIS HOUSE WITH ONE LEG?

11.

WHO HAS HIS CUT-OFF ARM GROW AGAIN?



12.

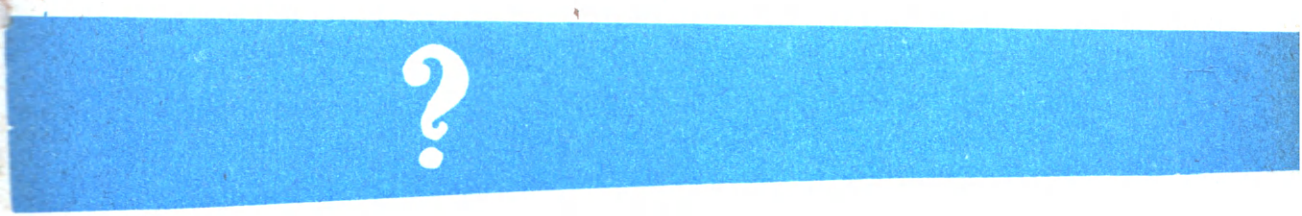
WHAT STAR GOES HUNTING?

13.

WHAT BIRD HOLDS ITS EGG TO HATCH IT?

14.

WHAT BIRD LAYS ONE EGG IN TWO YEARS?



15.

WHAT WORM CAN MATCH A WHALE?

16.

WHAT FISH BUILDS A NEST?

17.

WHO CAN BORE A ROCK WITHOUT A BORE?

18.

WHO STUNS FISH WITH HIS TAIL?

19.

WHO CARRIES AN INK-WELL INSIDE HIM?

20.

WHO BUILDS A TRAP FOR HIMSELF?

21.

WHO IS BORN ON LAND BUT LIVES IN THE SEA?

22.

WHO SWIMS TAIL FIRST?

23.

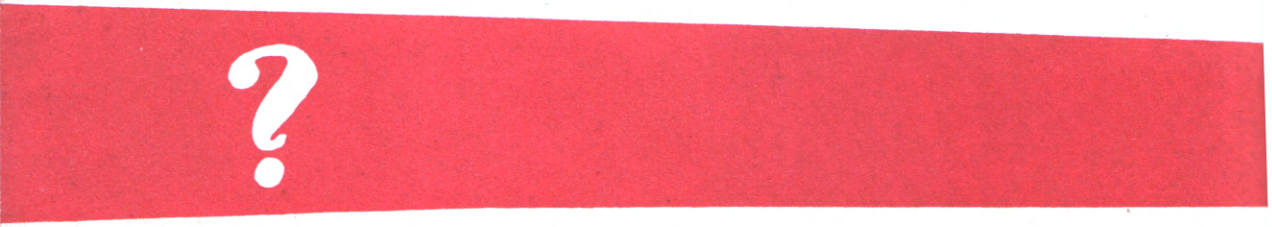
WHO BLUSHES WHEN HE SEES HIS FOOD?

24.

WHO BREATHES THROUGH ONE NOSTRIL?

25.

WHO PLOUGHS THE SEA-FLOOR WITH HIS TUSKS?



26.

WHO CAN FLY BUT ISN'T A BIRD?

27.

WHO RIDES THE SEA ON A SHARK?

of varicoloured actinians. True, the undersea gardener complained that a hermit crab had whisked away one of them during the night and now carried it about on its back.

As they swim along the walks the children feed the merry schools of small fish as if they were pigeons. Large fish swim up to the park grating and peer in.

A bunch of school children on an outing swim from behind a coral pavilion. They make for the oyster beds. Their teacher wants to show them how pearls are formed. A pearl is an outgrowth on the body of a mollusk when a sand grain gets into its shell.

"But where's that park?" you may ask. It doesn't exist yet. I am just picturing to myself how people will spend their Sundays in the future.

You doubt it?

Let's have a bet. Park or no park, underwater strolls are becoming quite an ordinary thing.

There's already a world's champion harpoon-rifle shooter. His rifle doesn't discharge a bullet but a steel rod known as a harpoon. The harpoon is tied to the rifle by a steel hawser to prevent the fish it hits carrying it away.

It is no longer unusual to see a sportsman on the seashore equipped with a mask, breathing tube, and flippers. I could tell you many interesting things about underwater swimming competitions.

But I'm in a hurry now. They are knocking on my door—the crew of the *Subviewer* has decided to fish in the Sea of Japan today.

Fishing under water is far more dangerous and difficult than from the shore.

In a forest or a field, a hunter can shoot game two hundred metres away. If he misses he can quickly reload his rifle and shoot again.

The range of a harpoon rifle doesn't exceed six metres, and the rifle fires only one shot.

But nothing could stop us. The captain kept watch on board while we dived, Keepmum and Katya swimming one way and Maya and I the other way.

I felt as if I wasn't swimming but flying like a winged bird. It was fun looking at the bubbles we breathed out as we swam farther down into the twilight under water.

Greenish reflections tinged our skin. "She's like a mermaid," I said to myself as I looked at Maya.

We swam over underwater meadows. A sting ray we scared shot up like a fabulous devil from a thicket of sea grass.

We darted over underwater gardens. There are no insects in the sea and very few flowering plants. The weird varicoloured "shrubs" and "flowers" we saw in the undersea garden were marine animals, corals, actinians and sea lilies. There are more plants on land than animals. In the sea it's the other way round.

"Look up," Maya signed to me.

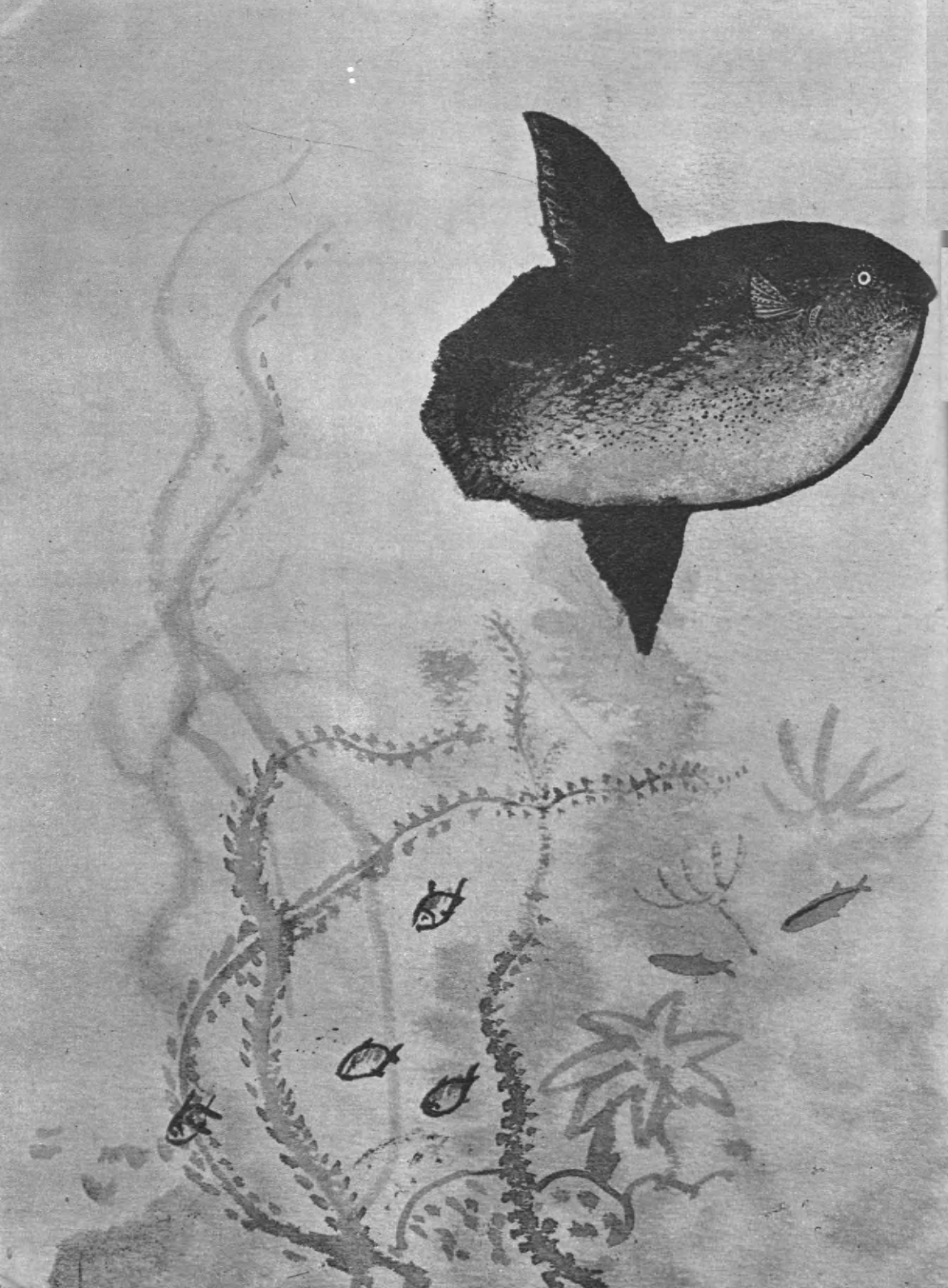
I did. The moon was floating unhurriedly overhead. But, of course, it wasn't the moon but a moonfish, flat as a platter. Some species of this living deep-sea moon measure two metres across.

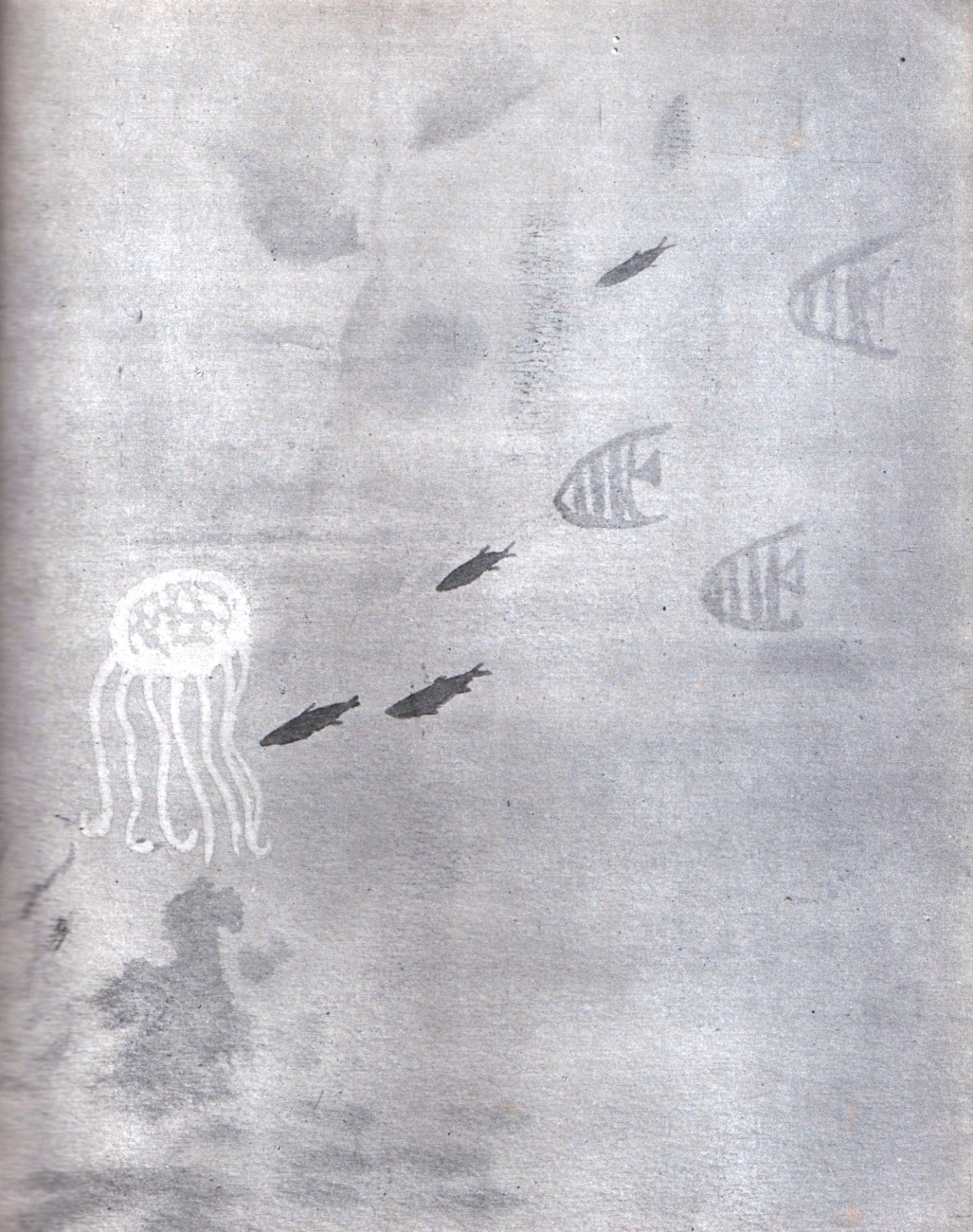
I was so spellbound by the moonfish that I almost touched a jellyfish drifting by. It was just as well I didn't. This sea nettle stings painfully even though it's just a lump of jelly.

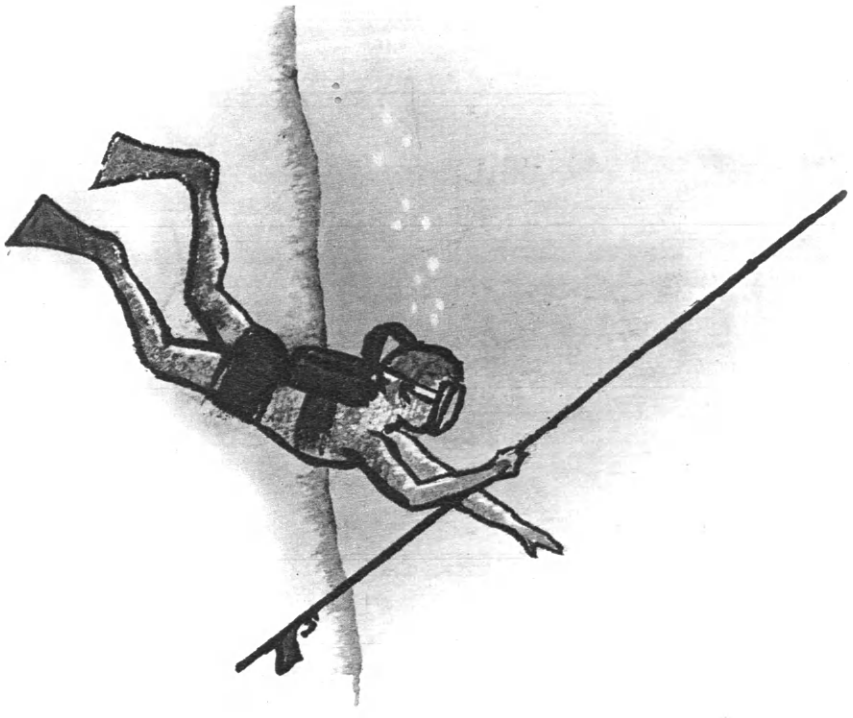
However, it doesn't always sting. In the Barents Sea there is the giant Cyanea jellyfish, with its twenty-metre-long tentacles dangling from under its huge bell-like cap like the beard of a sea god. Young cod scurry under the bell and among the strands of the stinging "beard". They are insensitive to the sting of the tentacles, and the "beard" protects them perfectly from their enemies.

The Cyanea's hospitality is not disinterested. The young fish it protects attract other fishes, to which the touch of the "beard" is deadly.

The jellyfish Maya and I came across wasn't a giant like the Cyanea but it could sting too. We by-passed it and went deeper down. We wanted to see those that lived on the very bottom.







We circled for a long time among rocks that were shaggy with weeds. Maya apparently couldn't decide where to stop. While she tried to make up her mind, I looked around and saw a rock. At its foot was a hummock looking like an uprooted stump with long, thick roots spread out. Suddenly the "stump" stirred, and began to move its "roots". Waving its arms menacingly, an enraged octopus was coming at us.

THE GHOST OF AN OCTOPUS

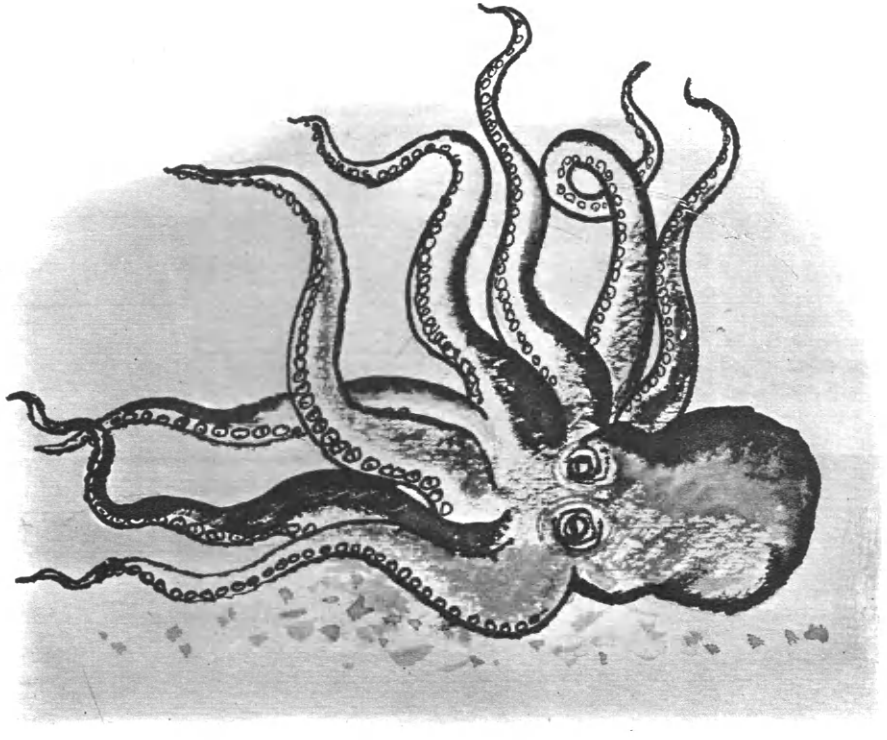
Every time I think of it I tell myself how lucky we were. A diver seldom has a chance to see a large octopus. This calamary (that is, a mollusk whose arms serve as feet) is cleverer than its relatives.

Its body is unprotected by a shell. The octopus is strong and agile, cautious and cunning. It is said that while the creature sleeps six of its arms are motionless while the other two circle over it, curling like question marks. These two arms are like sentinels—they are there to give timely warning of danger.

An octopus usually chooses a sheltered nook for a "bedroom". A large empty shell makes a snug cradle for a young octopus. After crawling in, it pulls the two parts of the shell together with its arms, shutting itself in tight.

An old octopus often pulls rocks over a hole and spends the night there. Each of the arms of a large octopus is fitted with three hundred suckers which can hold many pounds' weight. While some of the octopuses wall themselves up in a stone house, others hide in rock crevices.

In short, it is not easy to meet the secretive octopus. We just had a lucky break.



I say this now. But at the time I couldn't utter a sound. Maya and I stood as if turned to stone.

The octopus took up a battle position. It fastened itself to a rock for support and threateningly thrust out its spare arms.

Its skin became spotted. It changed colour, turning purple at one moment and darkening to lilac or brown the next.

We looked on, spellbound.

Finally I gripped my deep-sea harpoon rifle. I took aim, but just then everything seemed to go dark—a black cloud suddenly spread through the water. The octopus was near at hand.

I shot the harpoon.

The next moment I knew I had missed because I had been fooled. The real octopus was slinking away behind a rock while what I'd fired at—its ghost—was dispersing, melting away in front of me.

What was I to make of that?

I recalled that when in danger an octopus releases an inky fluid which spreads in the water like a smoke screen. The ink cloud is about the same shape as the octopus, and this "ghost" throws the enemy off the track.

You may say what the captain said to me when we got back to the ship.

"Aren't you a fine hunter! We should be having octopus stew for dinner. People in China are very fond of the sweetish octopus meat. But you—you went and made a mess of things!"

But honestly I had a good reason. And not one but three. Some skin divers assert that an octopus is a very peaceful chap, and even claim they have done a few steps with one, but an octopus is not the best kind of dancing partner. The mere thought of those slimy tentacles with their greedy suckers holding you in their embrace, sent shivers down your spine. No thank you. That's one reason.

Objects under water seem to be a lot closer than they really are. That's the second reason.

And lastly, I was deceived by the inky cloud ejected by the octopus.

THE CRAB'S BRUSHES

And what about Maya? She was wonderful. I was sure she'd want to be sent home right away. But she didn't. All she asked was to sit on a rock and relax a bit.

That is not a good idea, though. Seasoned divers advise against walking on the sea-floor or touching it with your hands. Anything may happen. You may cut yourself on a sharp shell, step on the needles of a sea urchin that has dug into the sand, or tread on a crouching sting ray that will stick the venomous needle concealed in its tail into your foot.

But Maya swam more and more slowly. I could see that she was tired. So I looked for a suitable place to rest.

"This all right?" I pointed to a rock near which sea cabbage, a laminarian plant, grew.

The sea cabbage has only one leaf. When a new leaf grows, the old one drops off. But then this only leaf, besides being broad, is three metres long.

Maya liked the rock, but on swimming up to it we saw that it was taken. A crab was having breakfast there.

We decided to keep out of the way and wait till it was through. We wanted to get to know the crab better. So far we had only met it in tins.

As I say, the crab was having a meal. It always carries with it all the utensils it needs to prepare its food. One of its claws, the longer, thicker and broader one, serves as a crusher. With this the crab crushes

shells. Its other claw, which is smaller and jagged, serves as both a knife and fork. The crab cuts up its food and puts it in its mouth with it.

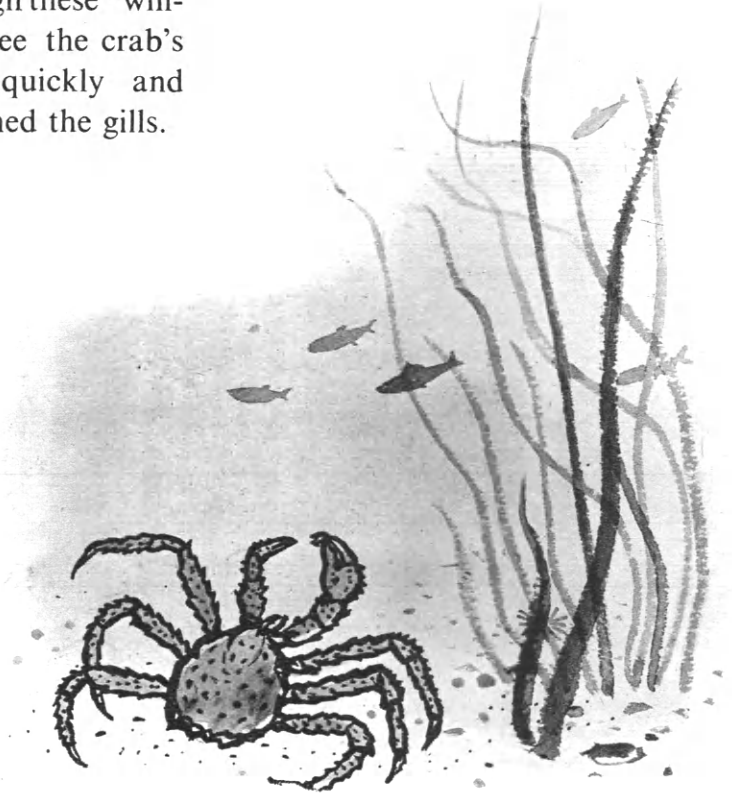
A crab can lift almost thirty times its own weight with its claw, while a man cannot hold even his own weight in one hand.

The crab finished its meal but stayed on the rock.

"What's it waiting for?" I thought, and guessed at once that it was trimming itself.

Besides its visible legs, the crab has two invisible ones hidden under its shell. With these "brushes" it cleans its gills.

Victor Baranov, a young Soviet scientist, watched a crab in a bowl. He had cut some holes in its shell and "glazed" them with cellophane. Through these "windows" he could see the crab's "brushes" move quickly and deftly as they cleaned the gills.



We couldn't see our crab working its "brushes". At last it sauntered away. We followed it out of curiosity.

The crab isn't a bad walker. It is known that swarms of crabs move shorewards in spring on their way back from the depths of the sea where they spend the winter. A swarm of crabs may have to travel about 180 kilometres—quite a stretch. But they move cheerfully along, at two kilometres an hour.

I think our crab went faster than that. As soon as it saw it was being followed it quickened its pace and disappeared among the rocks. But Maya wasn't vexed. At last she could sit down.

SCALLOPS

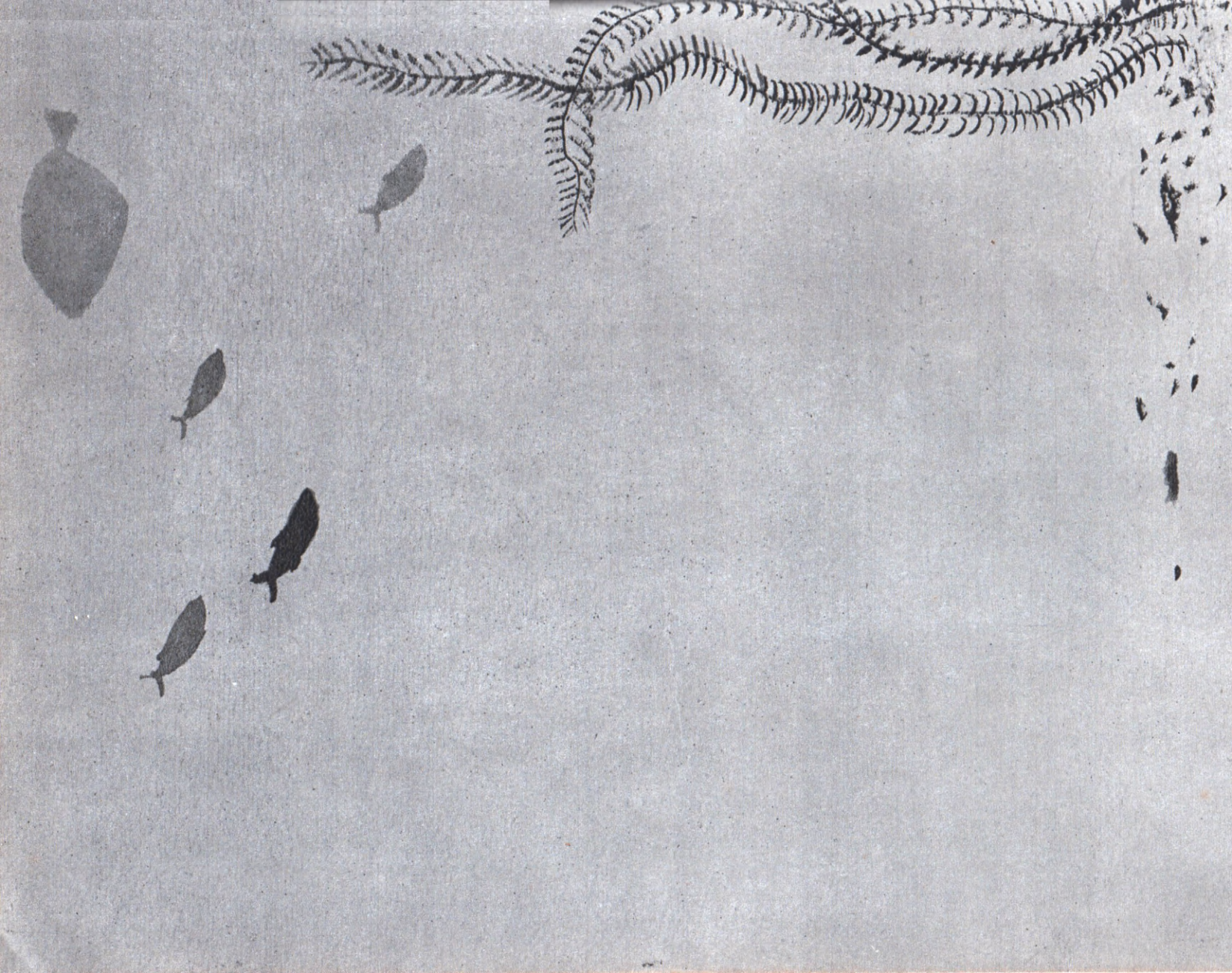
A rest, eh? I carefully examined the rock Maya had sat on. It seemed all right. But I thought I ought to check the sand around it. I raked it with my rifle and prised up a sea urchin.

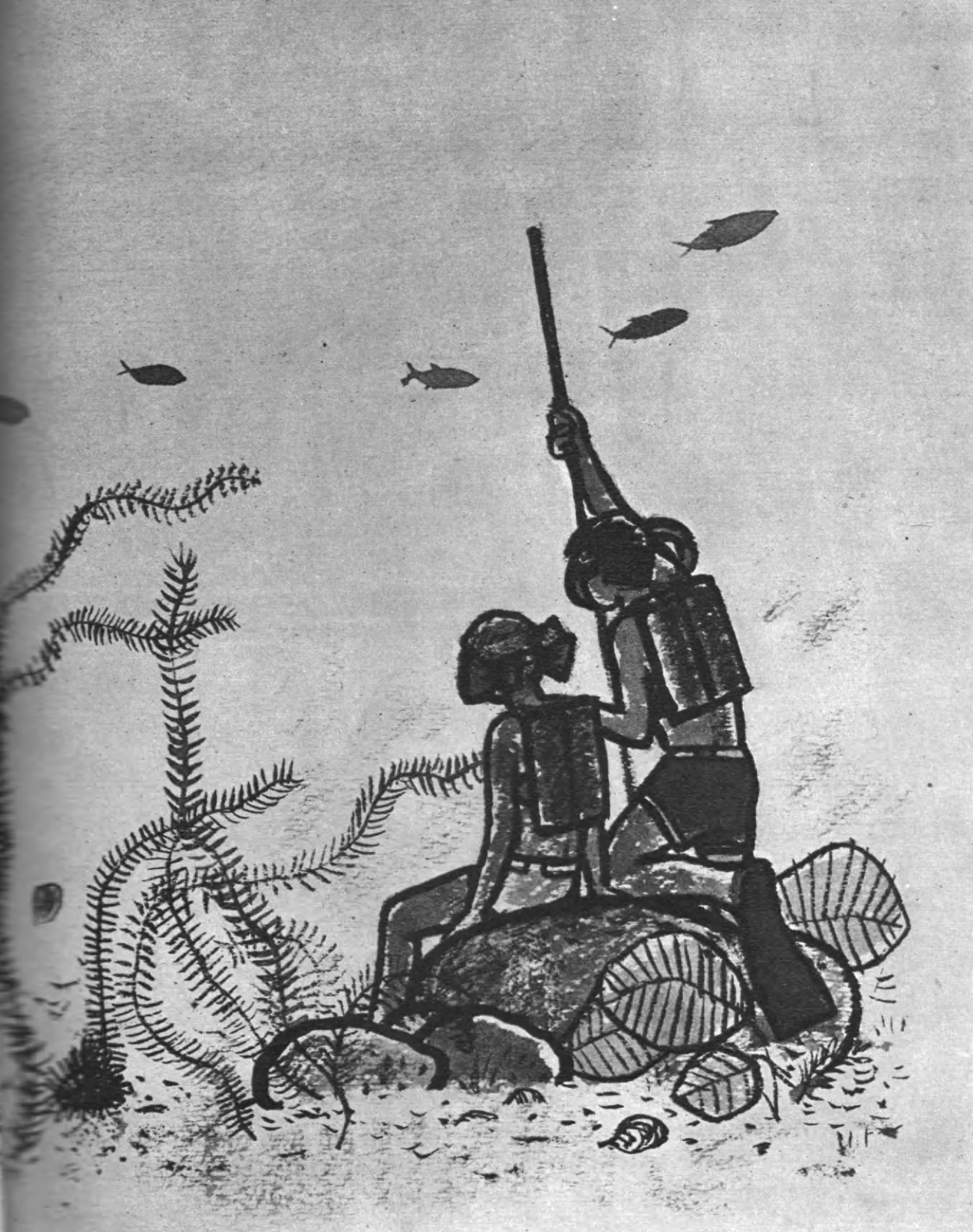
It would be hard to find another animal so strange as this. It's a flattened ball set with needles, with its skeleton on the outside and its muscles inside. Underneath it has five rows of thin, translucent sucker feet which enable it to crawl in any direction without turning its body.

The echinoderms, of which the sea urchin is one, are very ancient animals. Before there were any living creatures on land, sea urchins already crawled mouth downwards over the sea-floor.

I pushed the sea urchin away from the rock.

I ought to have probed the sand more but Maya wouldn't let me. I guessed that she didn't want me to shoo away those "wandering houses". This was the name we had given the univalve shells. The mollusk enclosed in this kind of shell carries its own house about with it. It has to carry it wherever it goes, even if it's only to have a meal.





Perched on a rock beside Maya, I watched the wandering houses crawl from place to place. Most of them moved very slowly, but that of a sea-ear mollusk fairly rushed past us. The sea-ear may be considered the sprint champion among snails. One metre per second is not bad going. Remember it has to crawl on its belly with a house on its back.

Another mollusk, the scallop, surprised us too. Its house is made up of two half shells closed tight like locked doors. There's not the smallest opening left. How could it carry its house?

Maya and I felt sure the house of the scallop never budged.

Suddenly we heard a sharp crack. One of the scallops leaped. Others followed it. It was quite a sight—a whole neighbourhood of deep-sea houses hopping about, banging their shell doors.

I chased one of the hoppers. The mystery was easy to solve. By striking its valves together, the scallop forced out the water and was flung the other way. Finally it was exhausted. It fell over on its side and lay still.

I bent down, hoping that it might jump up again. But instead of a crack I heard a splash behind me. Maya was frantically threshing the water with her hands and flippers, trying to get away from something that looked like a caterpillar.

Everybody in our class knew that Maya couldn't bear caterpillars. It was even rumoured that she had joined the marine study group because there was no danger of meeting a caterpillar in the sea.

The "caterpillar" was an ordinary holothurian, or trepang, crawling over the sand. It is a harmless echinoderm with a cucumber-like body on sucker feet. A Chinese would have rejoiced in the find, because trepang is a favourite dish in China.

I swam up to Maya and patted her gently on the shoulder, as if to say,

"Let's swim on."

She shook her head.

Girls certainly are queer. I just can't make them out. Maya hadn't been scared of an octopus but had gone limp at the sight of a "caterpillar".

Well, there was nothing for it but to go home.

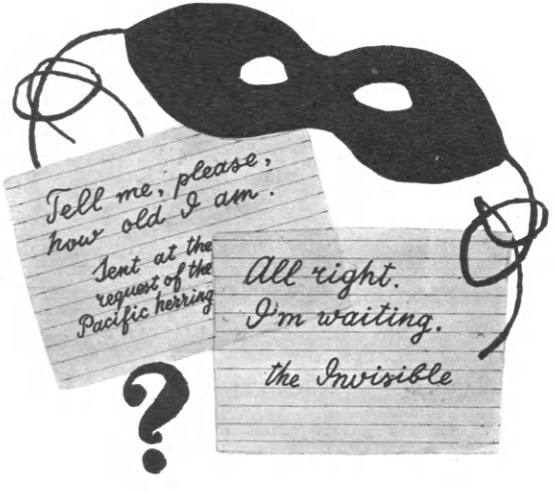
On the way back I managed to shoot a few fish. It would have been awkward to return empty-handed.

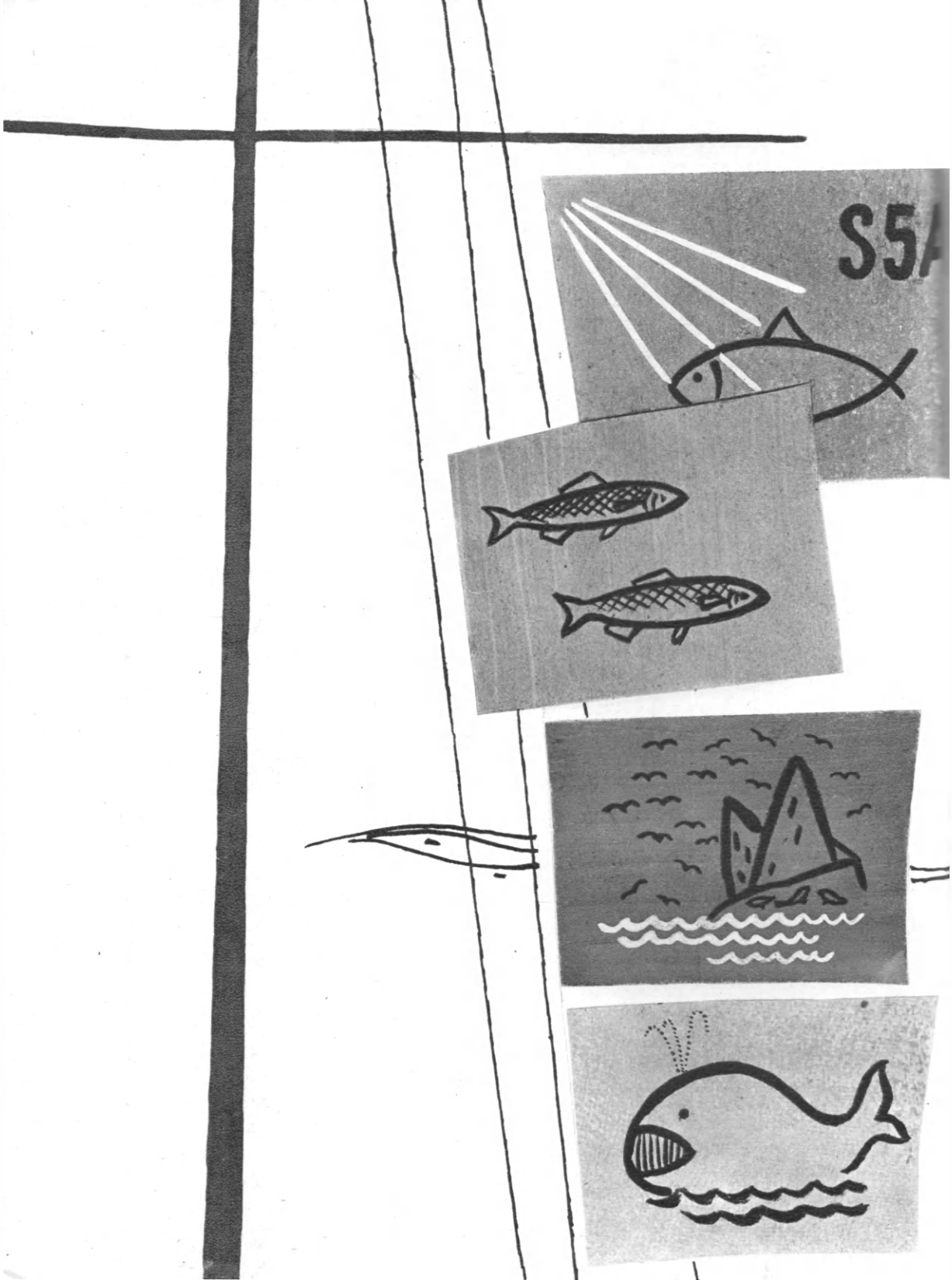
"They'll do," said Slava condescendingly, after inspecting my trophies. "But Katya and Keepmum have brought more."

"Glad to hear it. But you know what, captain? Your pilot isn't so very stupid, after all. The *Subviewer's* just like a fish when you look at it under water."

"It couldn't sail so fast if it were," Maya commented, taking off her flippers.

It couldn't sail fast if—why didn't that occur to me before? Now I had the clue to one of the Invisible One's riddles.

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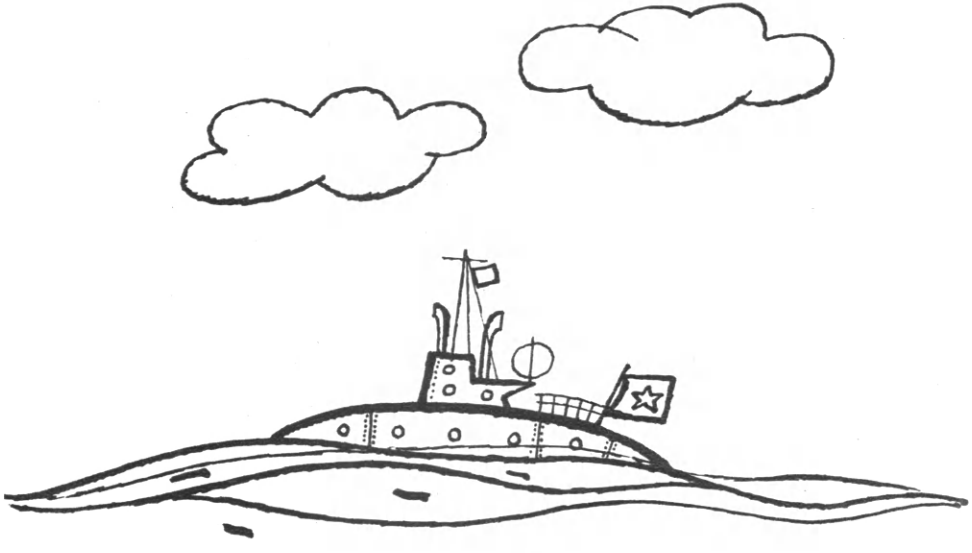


The Mark of Man

Diary Continued

THE INVISIBLE ONE CANNOT WAIT LONG

The Invisible One was in no great hurry for the answers. He was patient. But we realised we mustn't keep him waiting much longer.

We were now sailing in the Sea of Okhotsk. We had dubbed it the Salmon Sea because it yields such large catches of sockeye, humpback and king and dog salmon.

The *Subviewer* surfaced at frequent intervals. We were on the look out for a cliff where the guillemots have a rookery. On every ledge thousands of them sit side by side, each hatching its only egg. But we didn't sight one.

Sometimes the fog was so dense we couldn't even see the waves. Our smoke-grey flag seemed just right—that gloomy sea is often wrapped in fog even in summer.

The girls had asked me to paint a salmon and a rookery on the flag. And the captain had wanted me to add a "seal beach" at the foot of the rookery.

There is a lonely island in the Sea of Okhotsk whose shores are fairly black with fur seals. They are more numerous there than bathers on a sunlit beach.

It wasn't easy to fill all the orders. Listening to the screaming of Keepmum's saw, I laboured over the flag. Keepmum hated to be alone, and besides, the thing he was sawing wasn't for himself.

I couldn't put out of my head what Maya had said about submarines—that a submarine couldn't sail fast if it wasn't shaped like a fish. I was wondering whether she was right.

I had told Keepmum of an idea I had. Ever since he had been tirelessly sawing various little shapes out of wood. Occasionally I lost patience.

"Take a rest, Valera," I would say, "you've been at it long enough, you must be tired."

But Keepmum would just smile cheerfully and go on sawing.

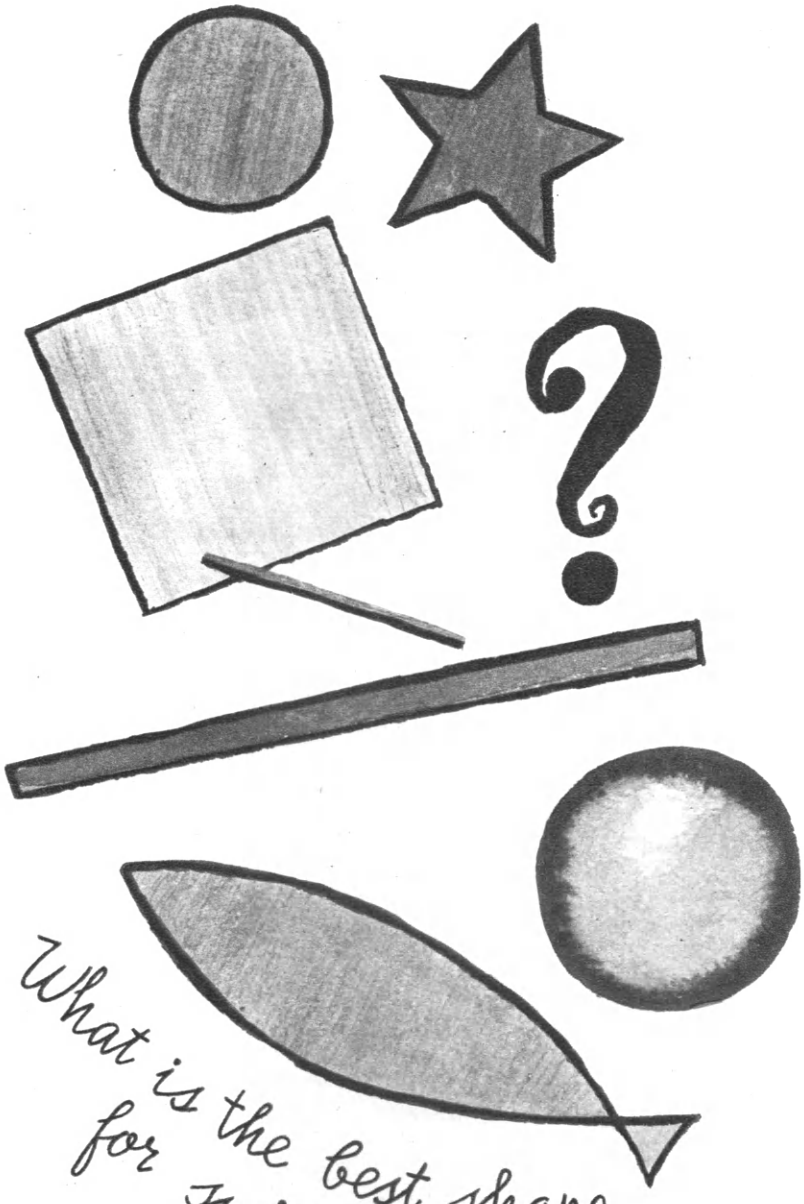
Then I'd go to the girls. They were either reading in the library, or in the laboratory pottering with the fish taken during undersea fishing trips.

"Well, how's things?" I would ask them. "What story can a fish's tail tell?"

"Wait a bit, we'll know soon."

At last the girls announced that they had made fish tails "talk". Good. Keepmum and I had also finished our tests. We had checked which of the little wooden forms floated faster—the fish, square, star, rod, disk or ball. The fish had turned out to be the fastest.

You can check that for yourself. And if you want to know why, find our pictorial marine newspaper, *The Way They Swim* in the colour insets and read it. It's our answer to the Invisible One.


What is the best shape for swimming?

Hardly an hour later a note was found pinned to our newspaper. The Invisible One was telling us he was satisfied with our answer. Anton Petrovich, too, praised the newspaper. Everything would have been fine had not the captain let us down. He was the only one who had not answered the Invisible One's question.

And why hadn't he? Maya assured us he was ill. She said he behaved in a queer way, mumbling words nobody could understand. Katya thought he was a windbag and idler and ought to be replaced.

"I'm going to find out for myself what's the matter," I said, and went to find the captain.

He was doing something very odd. He had rubbed the name "New Zealand" off the map and carefully printed "Cuckoo Island" instead. I couldn't let him get away with that.

"Why did you spoil that map? A fine captain you are!"

"I didn't spoil the map. I put right an injustice."

"Having fun, aren't you? You have plenty of time to do that but not to answer the Invisible One. Well, let me tell you there's a mutiny on board. The crew wants you to go."

Slava went red and then pale, and said nothing for a long time.

"Wait till we reach land," he said at last. "Then my helpers, the birds, will appear and I'll explain everything."

Maya was right. Something *was* wrong with the captain. I felt really sorry for him.

"Slava," I said in a friendly voice, "you lie down and have a rest. We'll take your temperature. You'll be all right, don't worry. Only, put those birds out of your head."

"Birds?" Slava spun round. "Some islanders discovered New Zealand by watching the migrations of the long-tailed Tahiti cuckoo. The great Krusenstern marked the spot on the map where through the fog he heard the cries of lots of birds. Three years later an island

was discovered there and was named after Krusenstern. And here are you, telling me to put them out of my head. You're just showing your own ignorance!"

I knew now why Slava had written "Cuckoo Island". But was that all the thanks I'd get? It was I who had taken pity on him and all he did was to sneer at me for it.

"Steady, now," I warned him. "You think you're a great scientist. But you couldn't answer the Invisible One!"

"I have my answer ready. Sea birds and fish help the captain in the air and in the water. By watching them you can tell how far you are from land. That's what the old sailing directions say. The pilot fish, for example, disappears as the ship draws near land. Birds—well, you can read about them in the birds' sailing directions I've drawn up."

"Let me read them."

"I must copy them first. At the moment I'd better tell you about it. Let's play a game. You be the sailor on watch. Report to me, the captain, on the birds you imagine you see in the air or in the water. Understand? Now begin."

I shaded my eyes with my hand, as if peering into the distance, and named the very first bird I could think of: "I can see an albatross."

"That's a bird of the open sea. Full speed ahead!"

"A sea gull!" I said, after a pause.

"A sea gull?" The captain stirred. "Is it crying?"

"No, it's just flying past."

"Then it must be a kittiwake, the only gull that flies far out to sea and is silent in flight. Other gulls don't fly out more than a hundred miles. Their cry is a sign land is near. Since it's a kittiwake, we won't change course. Steady on course!"

"I can see"—I liked the new game very much but I didn't know what bird to name next—"er, something bright in the water to port."

"That means we're sailing in tropical waters," the captain replied

readily. "When you see brightly-coloured snakes, you are approaching land. Port helm! Steer for snake. Slow speed. Keep'er so."

"Aye-aye, captain," I responded cheerfully. "I can see—"

"—that it's a quarter to two," the captain cut in unexpectedly, "and you have a radio contact with the Baltic at two. Can't you see the time? Then why aren't you in the wireless cabin?"

Bah! Whose idea was it that the captain wasn't right in his head? Why, he even remembered what I had forgotten!

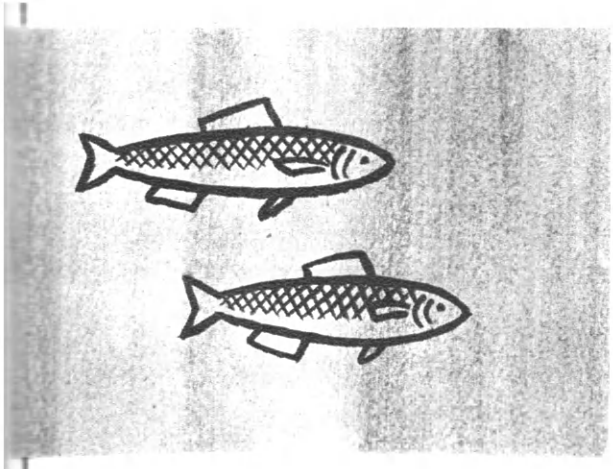
A CALL FROM THE BALTIC

"I'm the *Subviewer*! I'm the *Subviewer*!"

The crew pressed round me in the wireless cabin. Only the captain was missing. Keepmum had remembered to bring the amber-coloured flag, which I had painted beforehand to mark today's conversation with the Baltic.

For the *Subviewer*, now sailing in Far Eastern waters, was the flagship of our 5A form. Our classmates were also sailing in the Baltic and Black seas. We had agreed that they would radio all interesting information to the flagship. If they transmitted on the Friendship wavelength, we'd be able to pick up their voices.

That day we were to speak with Misha, who had stayed behind on the Baltic coast. The Baltic is one of the youngest seas washing our shores. It's only 13,000 years old. It has changed its outlines and its name several times. Once it was called the Amber Sea. It was so rich in amber that people burnt it in their stoves. Perhaps Misha would tell us something about the amber islands which had disappeared? Or about a tumblerful of Baltic water? A thousand tiny algae can be seen in it with a microscope. A sea as rich in plankton as that must also be rich in fish. I had painted the tastiest of the Baltic Sea fishes, the sprat, on an amber flag.



"Baltic! Can you hear me, Baltic? Over."

Finally Misha answered.

"Mum sent me to a Young Pioneer camp. I didn't like it much because the sea's more than a mile away. But there's a river nearby. I used to go with a boy named Borya to see the fishermen. One day an old fisherman gave me an eel. It's a long fish that looks like a snake. He said, 'Don't let it slip away. An eel can scent the sea from a distance. Put it on the ground and it'll turn its snout seawards and start crawling. It'll crawl so fast you won't be able to catch up with it.'

"We laughed. Imagine not being able to catch up with an eel! But to be on the safe side, we threw a rag over the bucket we'd put it in.

"We took it in turns to carry the bucket. First I carried it and then Borya. Then I wanted to carry it again but he wouldn't let me. When I tried to take it from him both fell down and the eel slipped out on to the grass. I should have grabbed it but Borya stopped me.

" 'It can't get away from us,' he said. 'And we'll check by scientific methods what the fisherman told us.'

"Well, in the interest of science we gave it a chance to get away. It made off over the grass, slithering westwards to the sea and that was the last we saw of it.

"We went back to the fishermen and asked for another, just a young one.

" 'What?' said one of the fishermen. 'You'll be asking for pigeon's milk next. I've caught all sorts of fish in my forty years but, believe it or not, I've never set eyes on young eels or eel roe.'

"We didn't believe it. All fish spawn, and young fish are hatched from roe. Why should the eel be different? But when, in Leningrad, we went into a shop and asked for eel caviar, the assistant said we were just trying to be funny.

"I'd had enough of it. But Borya wouldn't leave it at that.

" 'Let's go to the Zoological Museum,' he said. 'They'll explain everything to us scientifically.'

"We went. This is what they told us."

THE EEL'S LAST TRIP
Misha's Story Continued

"Eels have inhabited European rivers since olden times, but no fisherman has ever succeeded in catching a young one. Indeed, the ancient Greeks believed that eels were born of ooze.

"Although nobody had ever seen a young eel, people had come across a small fish in the Atlantic Ocean that nobody had ever seen grown-up. Scientists called the undersized fishlet, which is as transparent as glass, the leptocephalus, and classed it among the leptocephali.

"It was only some sixty years ago that the fishlet had to be deprived of its special name. An Italian scientist counted the vertebrae in the dorsal column of the long eel and the short leptocephalus, and found their number to be equal. This couldn't be a coincidence. The scientist put the leptocephalus in an aquarium. And lo! the little one's

body gradually stretched out, its glass-like back darkened, and it became an ordinary eel.

"But that was only half the solution. To find out where the former leptocephalus—the eel's larva—hatched from roe, it was necessary to catch a fishlet no bigger than a bead, the smallest of the small. You try and catch one like that!

"Johann Schmidt, a Danish scientist, spent five years hunting for the bead-sized fishlet, and got nowhere. In the sixth year he found a small one and in the seventh, a smaller one. Each new tiny fishlet drew the scientist farther out to sea.

"Schmidt's ship was wrecked on some reefs. But he sailed in a new ship in search of the eel's home waters. After fourteen years, he and his assistants succeeded in catching bead-sized fishlets just hatched from the roe. They got them in a shoreless sea in the Atlantic Ocean, known as the Sargasso Sea.

"The Sargasso Sea is bounded by a warm current while around it rolls the ocean. From afar it looks not like a bottomless abyss but dry land, a collection of islands. These 'islands', however, are floating algae called sargassum. Once they misled Columbus, who on seeing them thought India was near.

"It is in these warm, still waters, in a thicket of floating weeds three hundred metres (about 1,000 ft) deep, that eels spawn and then die. The larvae that hatched from the roe are carried by an undersea current into the ocean, in the direction of Europe.

"After three years' wandering the bead-like fishlet becomes a young eel. It then swims into a river and stays there. And there is nothing—neither the sedge on the banks, nor the willows overhanging the still backwaters—to remind the eel of its faraway home.

"But ten, fifteen or even twenty years later the old eel starts swimming down stream. It is on its homeward trip, the last trip it will ever make. Eels can live in any river, but they can spawn only where they were hatched—in the shoreless sea.

"Where is our eel now? Borya and I often talk of it.

" 'Last night it was raining and there was no moon,' Borya told me on the phone. 'It was the kind of night when eels attack the locks. Our fugitive must also have crossed the locks then.'

" 'And when'll it reach its home waters?'

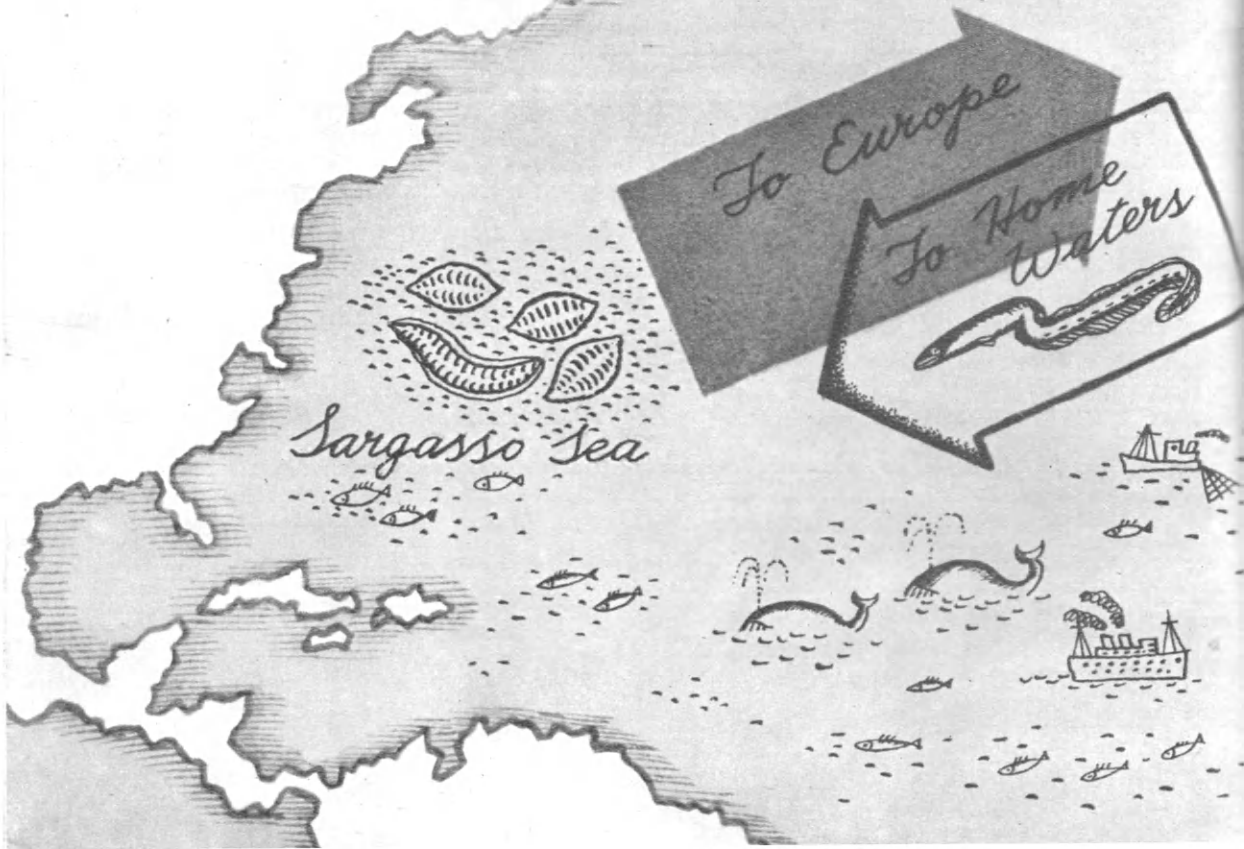
" 'That'll take time. The American eel, whose route is shorter, gets home in a year and the European in three years. We'll be in the eighth form by then.'

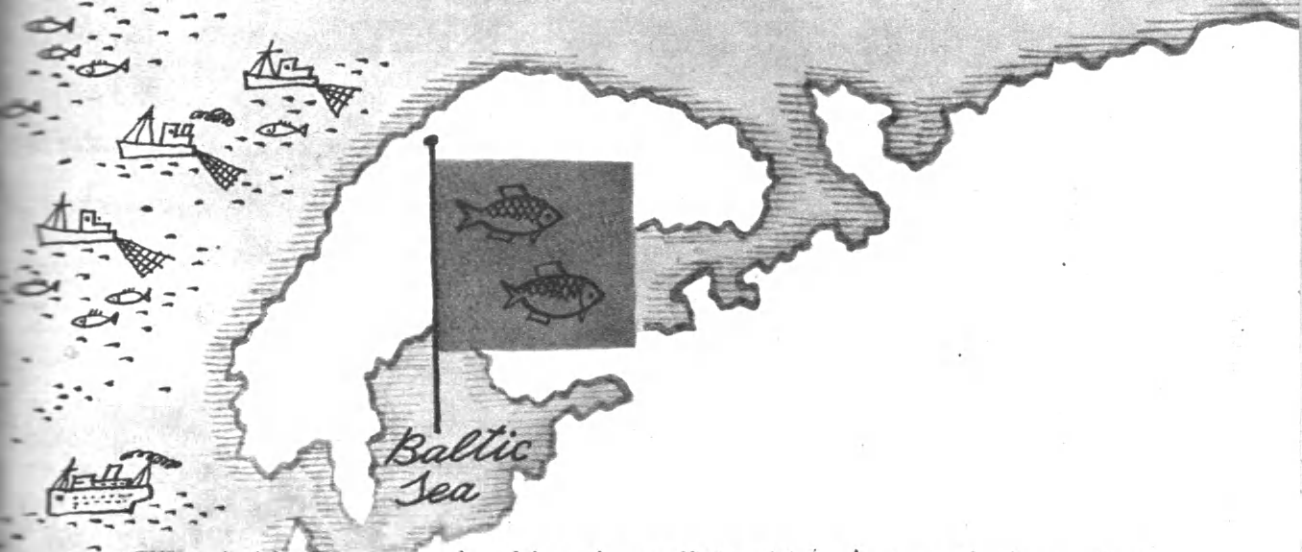
" 'But how does it know which way to swim?'

"The phone kept mum on that. I don't know, either. But I should like to know. Can you help?"

That was the end of Misha's story. He asked our help but Anton Petrovich wasn't with us. We ourselves knew no more about fish's trips than Misha or Borya did.

"Couldn't the Invisible One suggest something?" said Maya.





"I'll ask him to come in this minute," I said in jest, and threw the door open with a bow. "Step in."

"Oh!" screamed the brave Katya.

Someone in white stood in the doorway. But it wasn't the Invisible One. It was the captain.

"The p-pilot fish has d-disappeared," he said, stammering with excitement. "Land!"

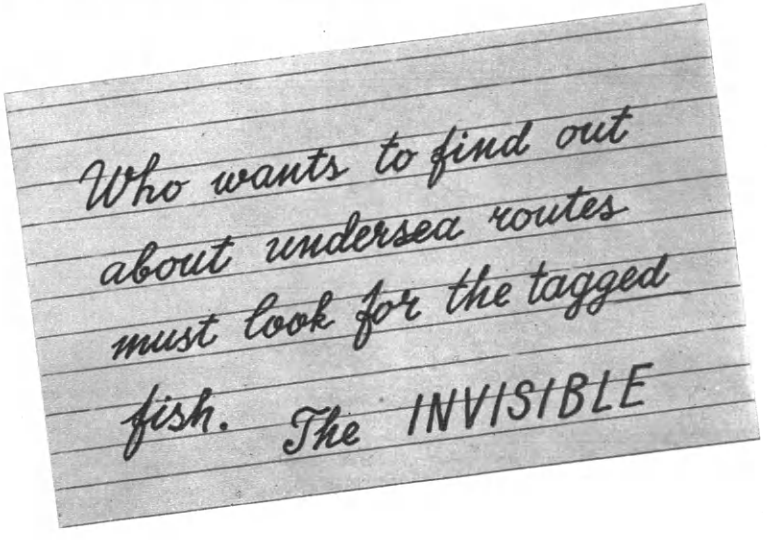
We rushed up on to the deck of the *Subviewer*, which had surfaced. But a dense fog prevented us from seeing whether the shore was really near. The captain was breathing noisily by my side. Small wonder—he was so excited. Indeed, where were his helpers, the birds he had counted on so heavily?

But hush! Gulls were crying in the fog.

"Land is near!" I trumpeted, cupping my hands round my mouth. "I can hear gulls!"

"Steer her for the gulls!" the captain commanded, cheering up.

When the fog had lifted we saw a wooded shore. But there was another surprise in store for us. It seemed that the Invisible One had boarded the ship under cover of the fog, had overheard our conversation and left a note which read:



Why, it was just like the fairy tale about Prince Ivan, who had to find a ring in the sea.

FISH DANCE

Keepmum and I were walking along the beach. We were going to look for a fish's ring. In the fishing village, on the shore of the Sea of Okhotsk, where we had halted, people from every part were waiting for the arrival of humpback shoals, which would come into the rivers from the sea to spawn.

I asked many of the fishermen whether they had come across a fish's ring. They told me they occasionally caught fish with ring-shaped tags. And if we wanted to know why fish were tagged like that,

we had better ask the scientists at the fishery station to whom those tags had to be delivered. A footpath running along the beach and up the river bank would take us to the station.

"Shall we go?" I asked Keepmum. The girls were busy studying fishing tackle.

Keepmum smiled and nodded. We took some bread, a bucket and a landing net and set out.

We walked till nightfall. Keepmum sniffed—there was a smell of river water. But what was that strange, dull noise? It was as if, without fire or smoke, a huge cauldron were seething and bubbling behind the shrubs through which the blue of the river flashed. We walked over and parted the branches, and then even Keepmum was unable to keep mum.

"Look—the fish are dancing!"

The river bulged with fish. Countless humpback that had swum in from the sea were swarming upstream. Jostling against one another, they dammed the river. Some were squeezed out on land, while those jammed amidstream were compelled to do a "fish dance".

Fish after fish leaped out of the water in showers of spray and dropped back into the river, scales glistening in the sun. The fish dance was accompanied by queer music—the bubbling, splashing, hissing of thousands of humpback spines cutting the water, and the rustle of fins rubbing against each other.

The crush can be even worse than what we saw. About a hundred years ago Crimean anchovies swarmed Balaklava Bay in such numbers that the water could not be seen. The bay seemed to be of silver. The anchovies choked themselves and crushed other fish to death. Only the lobsters managed to get away by crawling ashore.

I knew the story of the Balaklava crush from Granddad, who had passed it down from my great-Granddad. This time I was lucky enough to see a fish "dance" with my own eyes. The dancers looked so strange! I simply couldn't recognise the humpback, which up till

then I had seen only in pictures. You should have seen what was happening to them! Their backs were humped and their snouts curved like beaks, so that they could not shut their mouths.

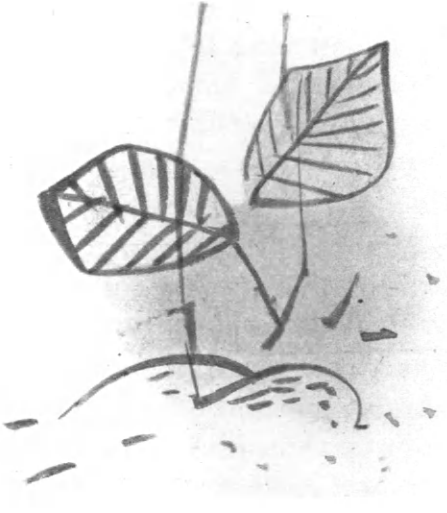
We had no difficulty in catching a couple. You could stun them with a club or just grab them with your hands. One of the humpbacks turned out to have pectoral fins that were too short. We put our catch in the bucket and went on.

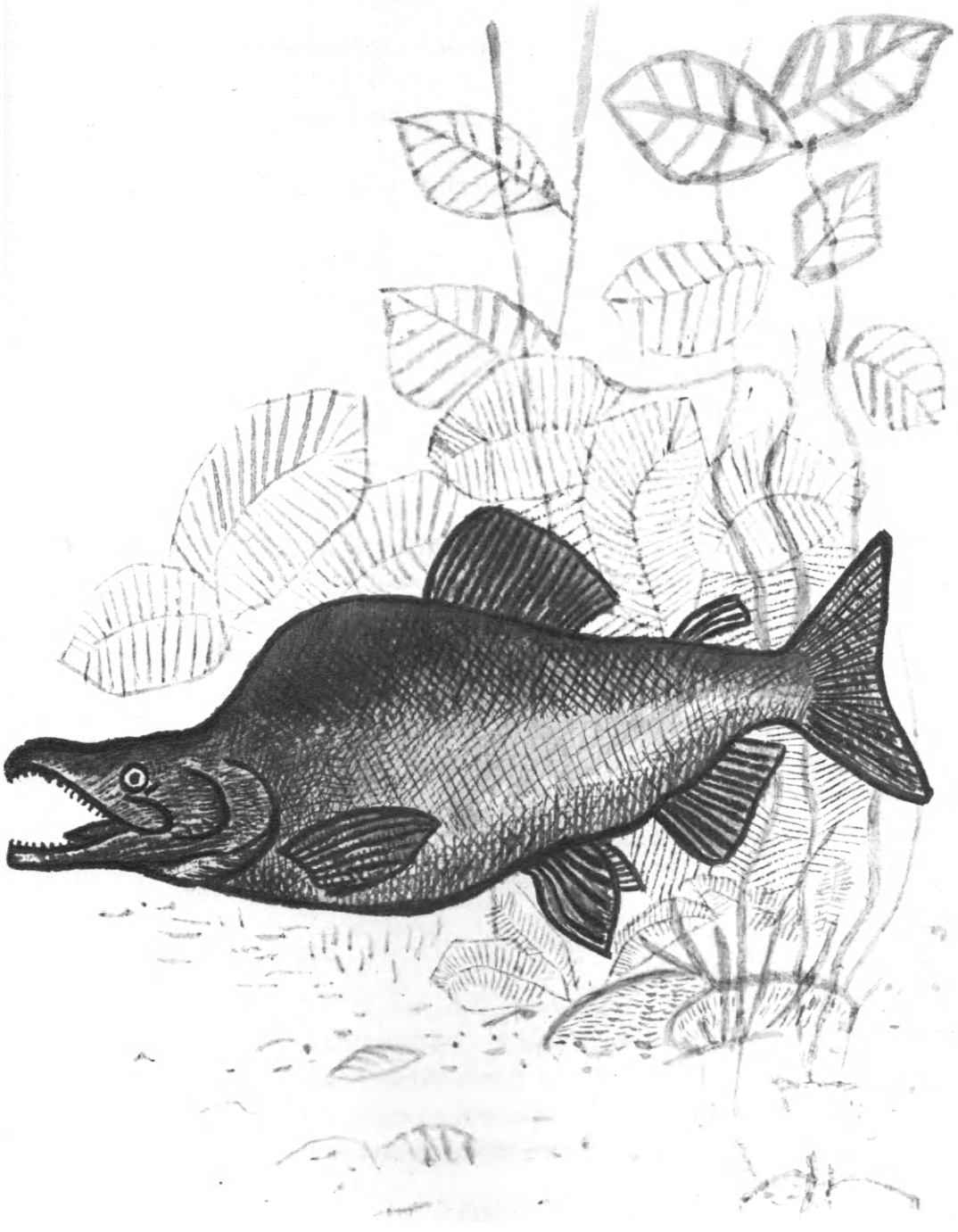
Our path became steeper as we went further. We could hear the river and the wind in the wood but no human voice. If only we could meet a hunter or a fisherman and ask him whether we were going the right way. Suddenly a dark shape stirred among the shrubs on the river bank. It was probably somebody fishing like we did—taking fish with his bare hands.

"Halloa down there!" I shouted.

The fisherman started and bolted, crashing his way through the shrubs. Keepmum and I stood still with fear. Do you know who I had called to? A bear!

When the thud-thud-thud of the "fisherman's" feet had died away we plucked up courage enough to go down to the water and take a look around. Mauled fish whose heads Bruin had had no time to bite off were quivering in the grass. In the rays of the setting sun, something like a light flashed on the scales of one of the fish. I bent down and saw a tag on a bit of silver wire. So that was the ring that sailed the seas!





We were so happy that we danced a jig, hopping as nimbly as the dancing humpbacks.

It was dusk when we reached the fishery station and knocked on the door of the nearest house.

"Who's there?" a man's voice called from inside.

"A fish's ring!"

A bespectacled man in a white smock opened the door. We said good evening. He asked us to come in and examined our finds.

"This humpback comes from our fish nursery," he said, meaning the short-finned monster. "As for the other traveller, we'll record it and send its passport"—he pointed to the ring-shaped tag—"to where it's registered."

"We shan't give you the ring without a reward," said Keepmum unexpectedly.

It was just like him, keeping mum for hours and hours and then saying something that made your eyes pop.

"A reward?" The scientist frowned. "You want money?"

"No." Keepmum shook his head vigorously. "Not money but a story."

"About undersea routes. And about—what did you call it?—the fish nursery, and the registration of fish," we replied eagerly, speaking together.

"I suppose I can't get out of it," said the scientist, smiling. "I'l have to pay the reward."

TRAVEL MISHAPS OF THE IWASHI

"Do you know a fish called the iwashi? It's our Far Eastern sardine. Some thirty years ago it swarmed to our shores, and was the chief food fish from those parts. And then suddenly it was gone. Where formerly the fishermen had got excellent hauls, now two or three sardines would be found floundering in the net. It was like a curse.

"Finally scientists found out the reason. The undersea road by which the iwashi had come to us was out of order. When a highway is damaged it can be repaired by a road-maintenance crew. But you can't repair an undersea road.

"Sometimes, when swimming in a river, you'll suddenly find yourself in a cold current. You swim on and the water becomes as warm as new milk fresh from the cow. You realise that there are different underwater routes in a river—warm and cold currents.

"They are much more powerful in the ocean. In the Atlantic, the most important warm current is the Gulf Stream, thermal station of two continents. It begins at the Mexican coast and flows northwards along the coast of America. The prevailing westerly winds there carry the warm waters of the Gulf Stream to Europe. The Gulf Stream keeps our seaport of Murmansk ice-free. The Far Eastern coast of Asia is washed by another warm current, the Kuroshio. The winds changed direction, the Kuroshio lost strength, and a body of cold water a hundred metres (300 ft) deep crossed the Sea of Japan. The iwashi got that far and stopped as if it had run into a wall.

"We see a road with our eyes. But fish are guided by road signs of their own. These signs are heat and cold, and the greater or lesser salinity of the water. With warmth-loving fish, cold water is like a road block.

"That's what happened to the iwashi. But in time the wind will change direction again and repair the undersea road, the sea will get warmer and the iwashi will start coming to us again by the familiar route.

"Guided by their sixth sense, that is, their whole being, fish remember invisible roads very well.

"When, in spring, the ice in the rivers breaks and fresh water rushes seawards, fish scent it thousands of miles away. It is to them the

forerunner of spring, and its call cannot be resisted. It tells them that the time has come to start on a long journey.

"Some people think fish, unlike birds, take no care of their offspring. Birds build nests and feed their fledglings. That's true enough. But while the partridge, mother of a large family, hatches out twenty-four fledglings, the salmon deposits forty thousand eggs and the moonfish three hundred million. How could fish build nests for such numbers of offspring?

"So the fish's chief concern is to spawn in places where their young will be warmest and best fed. And where would the fry fare better than in home waters?

"Home waters may lie very far away. The king salmon has to swim from the sea into a river and then upstream for four thousand kilometres, while the eel's route from the river into the sea is eight thousand kilometres. But they cover those distances.

"The way may be very difficult. What does a sockeye do if, moving upstream, it meets a waterfall! It presses its fins to its flanks, takes a leap and clears a barrier more than three feet high. And what about the humpback? After all, it has to crawl almost on its belly in shallow waters. But it does crawl, sinking its teeth into the tail of the humpback ahead and dragging itself along. No matter how hard the route may be, fish never turn back.

"The trip to home waters may be the last voyage. While the herring comes back from spawning grounds with scales scarred by hunger, the salmon and eel never return. During the voyage the humpbacked salmon changes not only outwardly, becoming a monster, but inwardly as well. It can no longer digest food. It is completely exhausted and falls asleep in the water.

"But it has done its duty. With the last of its strength it pushes sand over the hole in the river-bed where it has spawned, in the same river or channel where it was itself hatched from the egg—in its underwater home."

THE MARK OF MAN

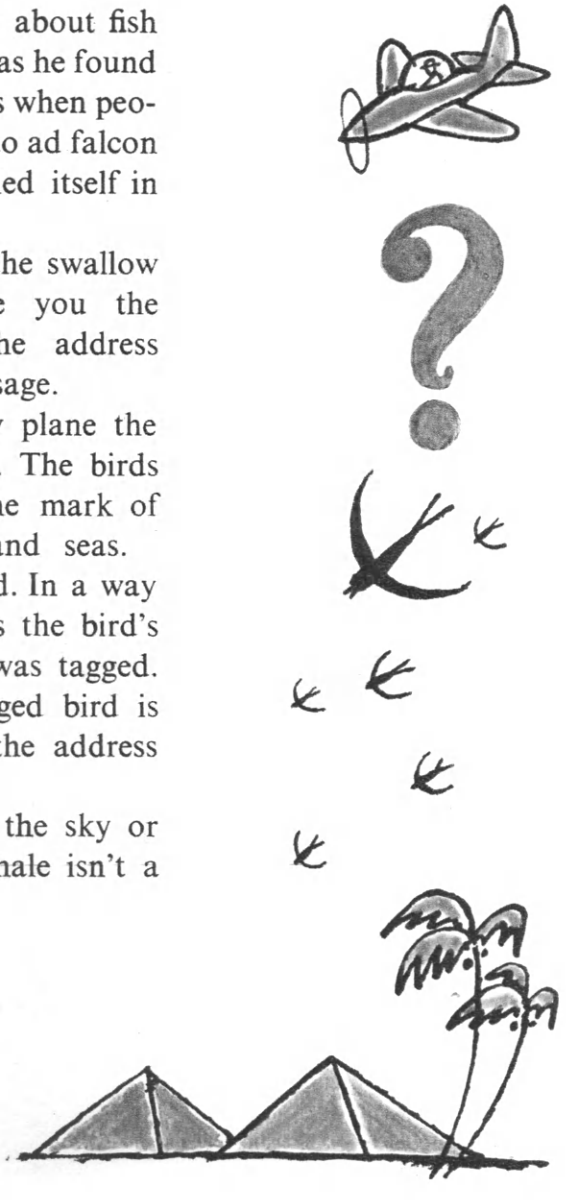
"But how did man find out about fish routes? Why, in the same way as he found out about bird's routes. Time was when people thought the cuckoo change to ad falcon in winter and the swallow buried itself in mud like a frog.

"Today, if you ask us where the swallow spends the winter, we'll give you the address, Egypt. We know the address and route of every bird of passage.

"Perhaps scientists follow by plane the flight of birds? No, they don't. The birds themselves bring with them the mark of man over mountains, forests and seas.

"A fledgling has its foot tagged. In a way that ring is its passport. It gives the bird's number and the place where it was tagged. Anybody who comes on a tagged bird is expected to report his find to the address on the ring.

"You can send a tag up into the sky or down into the sea. But the whale isn't a small bird, you can't tag it. So we mark it without touching it. A harpoon gun lodges a metal disk in the whale's back, and the whale carries it about until run down by whalers.

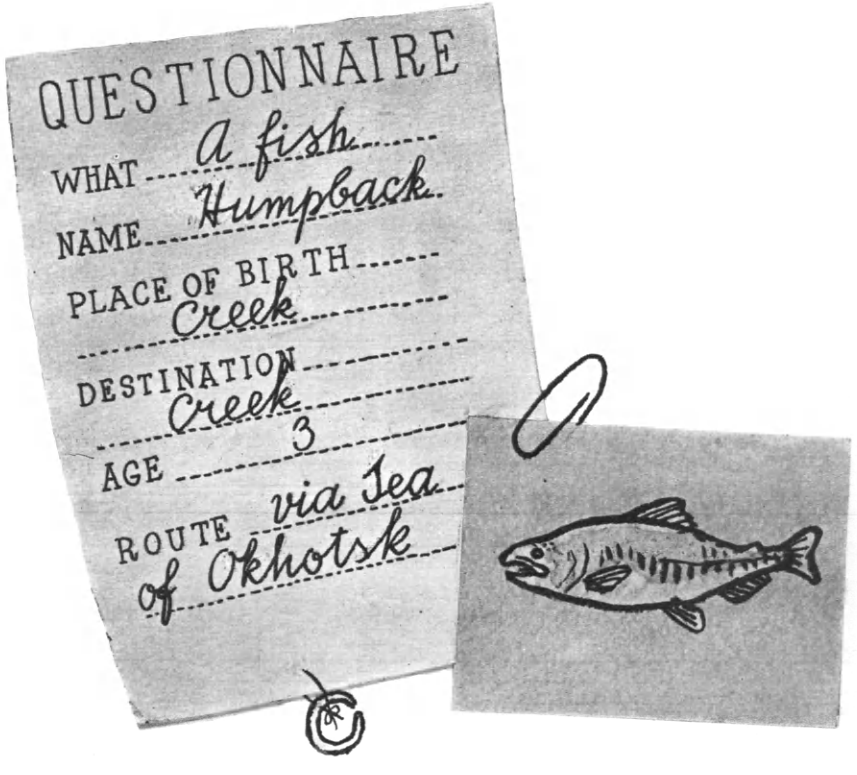


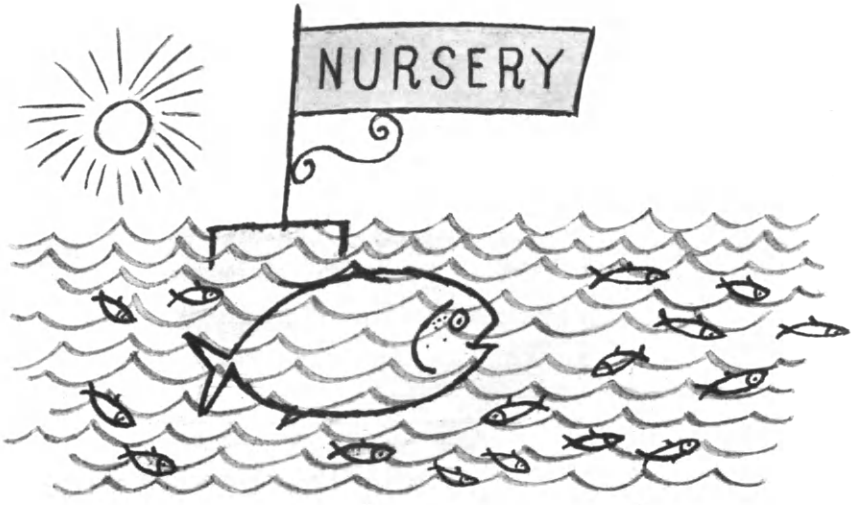
"An adult fish is dropped back into the sea after a numbered tag is put through its gill covers. Scientists who recover a fish's 'passport' like that can tell where the fish has come from, where and how fast it swims—in short, the whole of its life story.

"You can't tag a young fish because the tag's too heavy. So the marking is done by trimming the breast fins. They're of no importance for the fish but are a sure mark, because they don't grow again.

"Those trimmed fins have done science a great service. They've shown that a fish returns to home waters to spawn as surely as a bird comes home to build a nest.

"Our fish-farmers who are familiar with this invariable habit of fish, set up a 'marine nursery' for salmon, sturgeon and other valuable fish where the young are artificially hatched in ponds, lakes and reservoirs and later released into the sea. When they have grown up





they'll come swarming back into their home waters. That's the time to start fishing in a big way and build a cannery.

"Who could have believed, in the old days, that a fish feeder thirty thousand kilometres square could be set up in the sea? A feeder, moreover, in which the food supply increases? Such a feeder has been established, for the first time in the world, in our Caspian waters. Professor L. Zenkevich proposed transferring clamworms, the best food for sturgeon, from the Sea of Azov to the Caspian. In seventeen years the clamworm multiplied tremendously, with the result that the sturgeons' food stocks increased as much as if thirteen thousand waggonloads of the worm had been delivered.

"As you see, it isn't only the sea that

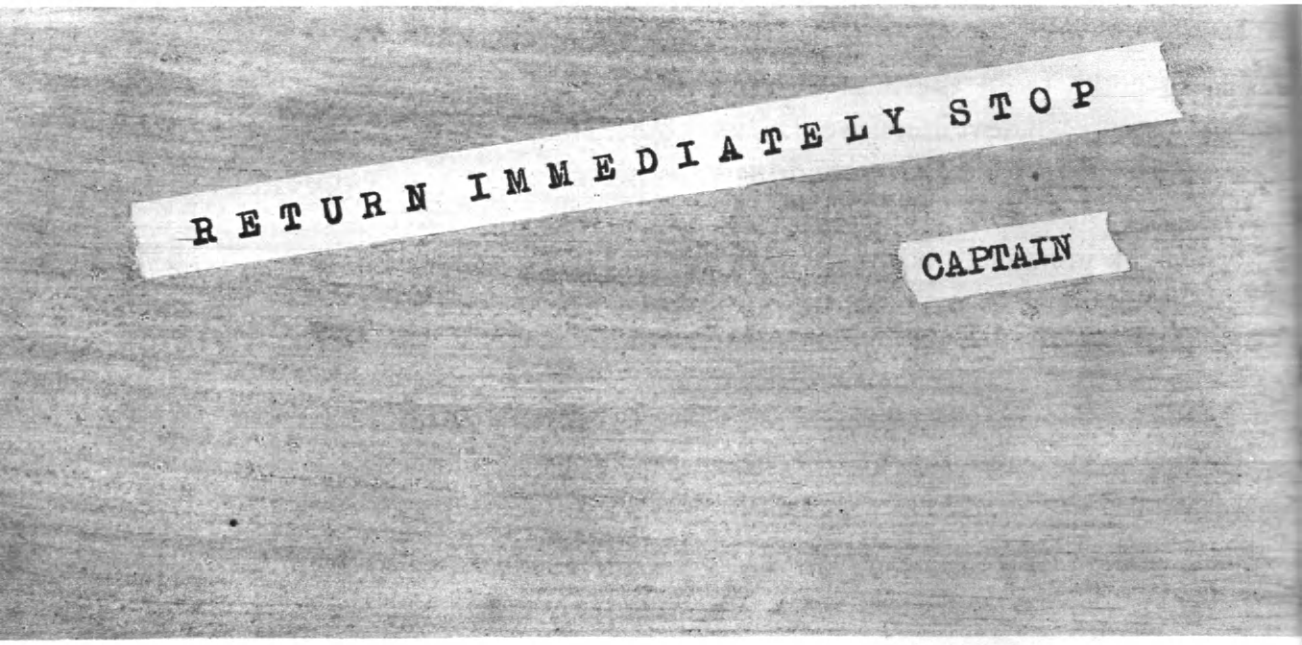
feeds man but the other way round, too—man controls the sea and settles it with new inhabitants.

"As a result of the work of our scientists, the Far Eastern humpback has moved into the Barents Sea, Baltic sprats into the Aral Sea and the Black Sea grey mullet into the Caspian. The Black Sea fish have become well adapted to their new home.

"At present our marine scientists are planning to move the Baltic cod to the Black Sea and the Kamchatka crab to the White and Barents seas. May they prosper there!"

THE SEA GULLS' FORECAST

We'd have liked to stay longer at the station to learn more about that calm lake, the "fish nursery", the work of scientists. But we received a telegram from Slava which read:



We returned. As we were nearing the village, the wind freshened, crests of foam topped the waves and fishermen could be seen heading homewards. Only powerful ships can cope with storm seas. Do you know what the waves are like in a strong gale? In mid-ocean they surge as high as a three-storey house.

The girls met us and took us to the house where we were to put up.

Slava was living at the far end of the village, so we couldn't talk to him.

"What's up?" I asked.

"The captain's received a gale warning from the gulls," replied Maya.

"Birds again," I said with a sigh. "Well, since the man who made the forecast isn't here, you tell us all about it."

Against the sounds of the gathering storm, we heard the story of the gulls' forecast.

The clever and the keen-eyed have assistants everywhere—in the air and the water alike. Sea animals—jellyfish and dolphins—serve as living barometers. But the gulls are the best marine weather bureau. They fish differently according to the weather.

Look how high they are now. They're clever—they are letting the air currents rising from the warm water help them to soar. It's up to man to decode the signal. If the water is warmer than the air, the pressure is low and the weather will change.

On another day you can see a different sort of fishing. The gulls sit on the water. That means it's hard for them to soar—the air is warmer than the water, the pressure is high and so fair weather will continue.

And what if the gulls skip about on the beach? That is a storm signal. During a gale food is plentiful on the beach—the sea casts it up.

How can gulls sense a gale in advance? Scientists offer various explanations. Some affirm that the gull's hollow bones begin to ache before a storm. Others believe that the gull can hear the "voice

of the sea"—distant oscillations which the human ear cannot detect.

"The forecast's correct," I said, listening to the surf roaring outside. "But I'd like to know when the gale will blow over."

I think I wasn't the only one who wanted to know that. No matter what we tried to talk about, we couldn't help returning to the gale.

"Fishermen say," said Maya, after a pause, "that some sixty years ago there was a strong gale on Sakhalin just when the herring were spawning. The waves washed up so much roe that after the gale the beach was spread with caviar for several miles. People just walked on roe. See what a wicked thing a gale is?"

"It depends," said Katya. "Marine creatures need gales. Gales air the storeys of the sea like fans. Those that live in the lower depths become short of oxygen, while higher up food is scarce. But a gale mixes up everything, adding air and warmth for some and food for others."

Keepmum spoke up suddenly.

"Our scientists," he said, "have been thinking of ways to increase the supply in the upper storeys of the ocean. Perhaps they'll be able to fertilise the sea or stir it without the help of gales."

"Say that again!" We pressed round Keepmum. But he retreated into a corner and fell silent.

HOW THE SEA ROBBED THE CAPTAIN

At last the sea calmed. We could have sailed on but the captain was missing and we started to look for him.

We saw a solitary figure wandering on the beach, among heaps of seaweeds. It was our weather man looking for shells.

"Halloa!" Katya called. "Isn't it time we sailed? It looks as if the birds are giving us a favouradle weather forecast."

Gulls tossed on the water like white petals.

"Yes," the captain agreed as he bent down to pick up a shell.

"Incidentally," I said, "it's high time we copied your birds' sailing directions into the log. Where are you keeping them?"

The captain thrust his hand into his pocket, fumbled, and felt in his other pocket. He blinked, the shells slipped out of his hand, and he'd have thrown himself into the sea had I not grabbed him by a trouser leg.

"Let me go! They're out there!" he yelled, pointing to the waves.

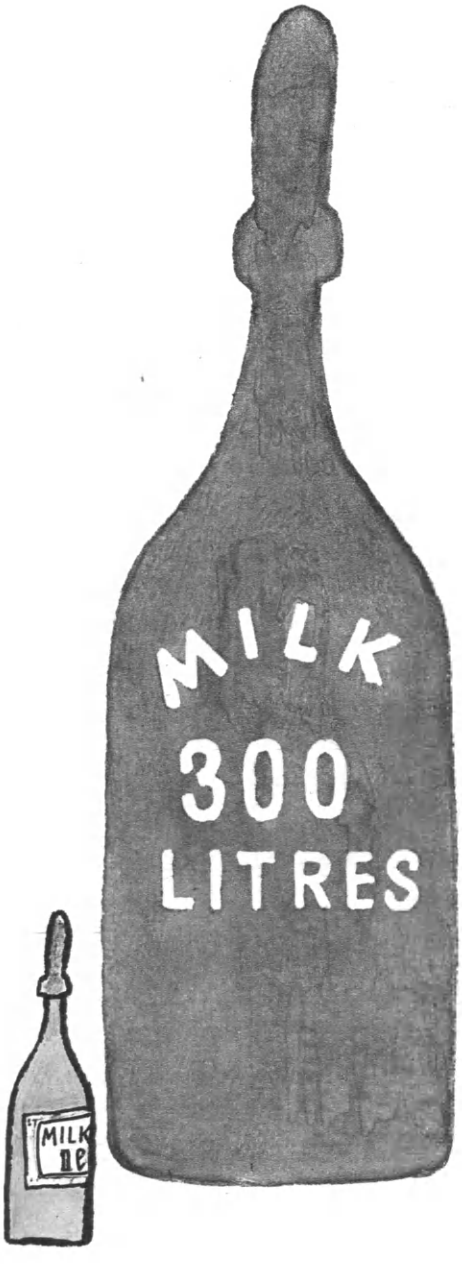
What a captain! He knew how to write sailing directions but had forgotten all about the tides. The sea ebbs and flows twice a day, giving two low and two high tides. Plants and animals of the coastal region lead a strange life. Twice in every twenty-four hours they live on land and twice in the sea.

During the "dry hours" the mollusk's house is locked—the valves are shut tight—shell fish hide under rocks, and the weeds droop limply. But as soon as the "water hours" come, the weeds straighten up the fish return, and the shell fish start scurrying about.

The captain had forgotten all this. At low water he had put his notes on a rock and begun collecting shells. Now the sea was back and the rock had disappeared under water. Perhaps those were his birds' sailing directions showing white on the water, or was it just foam?

We heard a suspicious sobbing sound and turned away. Of course, being robbed of your birds' sailing directions was reason enough for crying. But you mustn't overdo it.

"Don't be upset," we told the captain. "You'll write new ones. And what you've found out and remembered no sea can wash away."



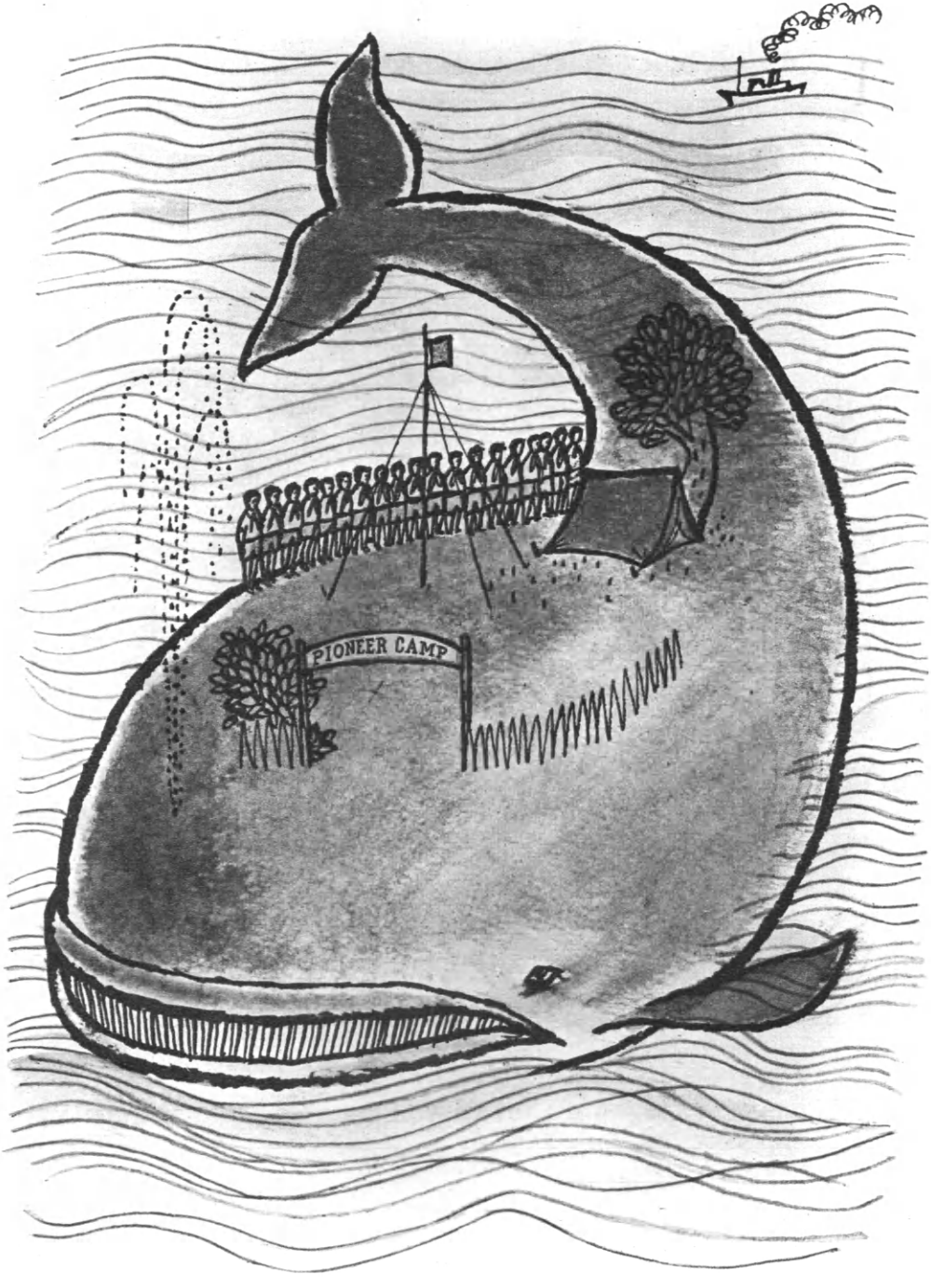
WONDER FISH

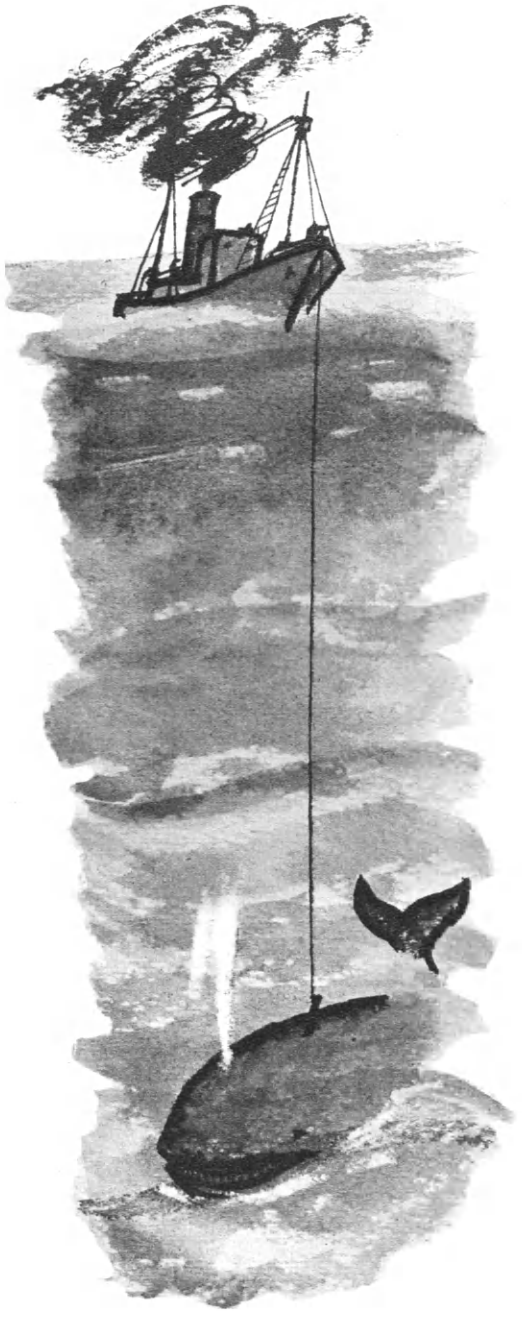
We passed the Kuril Islands where streets are paved with rock bombs ejected by a volcano, and where steam so hot that you can cook rice in it billows here and there on the beaches.

We were sailing in a new sea now, the largest and deepest of the seas washing our shores. It has been named after Commodore Bering, the famous eighteenth-century Russian navigator.

The *Subviewer* kept on the surface all the time. The man on watch continually scanned the sea through a pair of binoculars—for all he knew we might see the Soviet *Aleut* whaling fleet, which in summer whaled in these waters, or even a whale. I had already painted one on our flag for the Bering Sea. As I was painting it I listened to the story of the giant "wonder fish".

The whale's young is the biggest of all babies. Only once in two or three years does the mother whale give birth. When it's only a few hours old and cannot swim yet the baby bobs upright in the water like a float. The new-born baby is seven metres long and weighs five tons. Of all the milk-fed babies, it is the only one that is born in the sea.


PIONEER CAMP



The wonder baby grows by the hour. And why not? After all, it sucks from two to three hundred litres of milk a day. And what milk! It is like cream, and is fifteen to twenty times as rich as cow's milk.

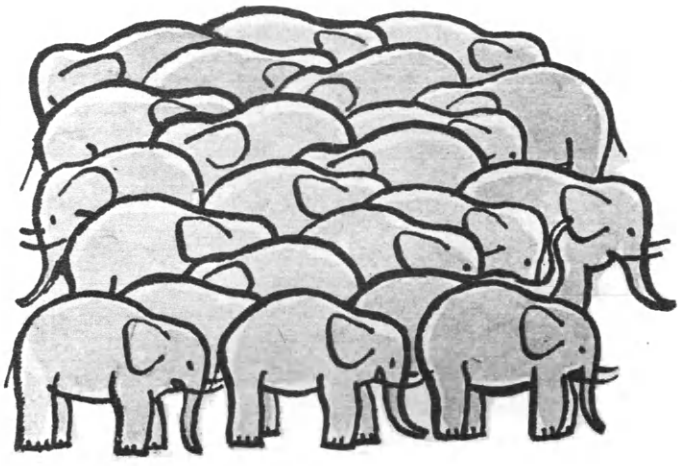
In time the wonder baby becomes a "wonder fish".

That's what the whale is called in a Russian fairy tale. As the tale has it, the "wonder fish" lies across the sea, with fenced houses and trees on it.

But the truth about the whale is no less amazing than the tale. There are no trees on the whale, but the "lips" of the sperm whale are yellow with the tiny weeds that grow on them. You cannot build a house on a whale's back but the thirty-three-metre long blue whale is big enough to accommodate a Young Pioneer group and a tent.

The whale is enormous and so is everything it has. Its tongue is like a lorry and weighs three tons, and its intestines are long enough—a quarter of a kilometre—to supply water piping for a side street. On the Kurils, whale ribs sometimes serve as football goal posts.

If you cut a whale's liver into hundred-gram helpings, you can feed ten



thousand people with it. But you mustn't do it because the liver is so rich that anybody who ate it would become ill.

A whale yields as much fat as a one-thousand-head pig farm. It weighs more than twenty adult elephants or a herd of bulls.

That is what the "wonder fish", the largest animal on earth, is like.

It has the strength of one thousand seven hundred horses. With a blow of its tail it can smash a boat to bits. Once a wounded sperm whale knocked off a ship's screw with its head. Another whale, hit by a harpoon on a line, dragged a whaling ship of six hundred tons after it. It towed the ship like a tug although the ship's engine was working full speed astern.

That is what the "wonder fish", the mightiest animal on earth, is like.

The water a whale breathes out makes a spray that seems to us like a fountain three storeys high. When a grey whale spouts there is a fragrance like fresh cucumbers.

The whale itself cannot smell its own odour or that of others because it has no olfactory organ. And a whale never weeps—it has no

lachrymal gland. Instead, it has blubber, secreted by a special gland that oils its eyes, protecting them from the salt sea water.

The whale is short-sighted under water and half-blind on the surface, but it has amazing ears that can catch a sound miles away.

Seals and sea leopards feed in the water but they rest on land or on ice. The ocean provides the whale with board and lodgings, and is a great cradle for it. Not once in its life does the whale touch land.

That is what the "wonder fish", the most fabulous animal we know of other than in fairy tales, is like.

We were lucky enough to see it.

The captain saw it first.

"Whale in the offing!" he shouted.

SEA TIGERS

The binoculars passed from hand to hand. The whale wasn't alone. High dorsal fins flashed in the waves to the right and left of it. By those huge fins—like scythe blades—we recognised its pursuers.

"Killers!" said the captain.

"Sea tigers!" added Katya. "It's not for nothing that these dolphins are called tigers—they've tiger's teeth and spare nobody. It's only they that attack whales."

We actually witnessed that murderous attack.

We were so sorry for the poor "wonder fish"! For all its strength, the whale was powerless to defend itself. The killers avoided the terrible blows of its tail and attacked it from the sides and from the front. And in front the whale is helpless, for it has neither claws nor teeth.

"They'll carve it up alive," muttered the captain. "They'll sink their teeth into its snout and tear out its tongue and then they'll start snatching chunks of flesh from its sides."

MARINE HERALD

PUBLISHED BY THE S5A • EDITOR-IN-CHIEF *Yura Kazantsev*

THE WAY THEY SWIM

There are too many animals in the sea to draw them all. So let at least these thirteen inhabitants of northern and southern seas tell how they became adapted to life in the water.

AN ANIMAL OF WATER

The jellyfish contains so much water that it is transparent. A creature which hardly weighs anything and is itself water, it can only drift on the waves. There exist transparent fish and transparent cephalopod mollusks. Some of them cannot be caught in a landing net – the delicate body is cut by it and flows out.

Jellyfish

AN ANIMAL OF FAT

The whale shark, the biggest of all fishes, "grazes" in floating pastures. This sixteen-metre-long mass of flesh and bone can stay on the surface for hours, kept afloat by its own fat.

The giant whale, the tiny plankton alga and all marine swimmers contain fat. Fat helps them to swim because it's lighter than water.

Whale shark

BUILT-IN OARS

See what's become of the legs of the turtle – the sea has transformed them into oars. The turtle is clumsy on land, but in water it swims gracefully and fast. Its four feet serve as oars.

Turtle

HOW THE SEA RESHAPED AN ANIMAL'S FEET

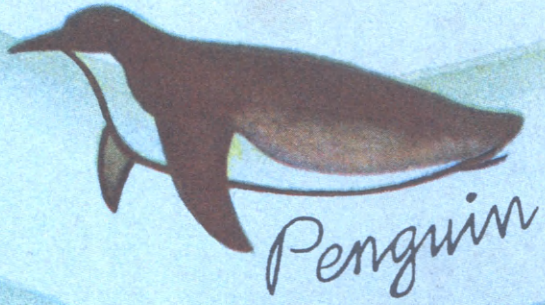
Your fourth finger is your smallest finger. The first and fifth toes on the seal's hind extremities are the biggest. Between them is a web indented like a fish's tail. It helps the fish-hunting seal to swim faster.

The sea has modified the extremities of the whale and dolphin even more than that. They have become flippers.

Seal

HOW THE SEA UNWINGED A BIRD

The sea has also reshaped a bird's wings. The penguin, an Antarctic bird, can no longer fly, but it can move through water faster than a submarine. It doesn't flap its oar-like wings like a flying bird but moves them with a rotary motion.

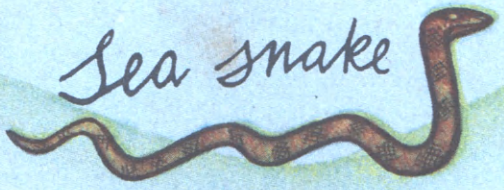


DEEP-SEA ROCKET

By contracting its muscles, the squid ejects a jet of water. The reaction propels it in the reverse direction. There are jet-propulsion engines under water as well as on land.

WHY SNAKES COULD NOT CONQUER THE SEA

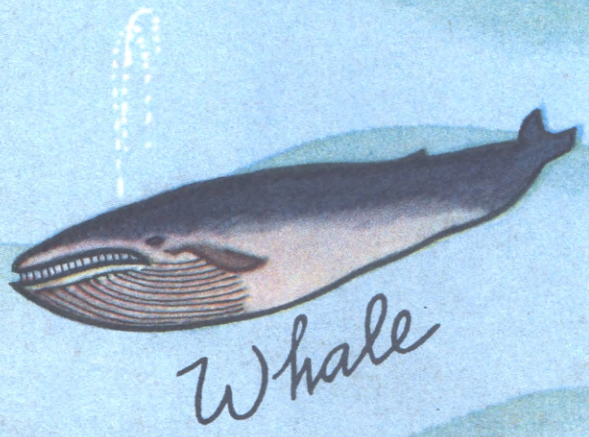
In the sea, the fastest swimmers are the strongest. A fast swimmer can get away from its pursuers and overtake its prey. That is why snakes couldn't conquer the sea. A thing that must wriggle along cannot swim fast.



HOW THE SEA ROBBED THE WHALE OF ITS FEET

The whale's ancestors had feet but through living in the sea for a long time the feet were lost and the whale came to be like a fish. It has a fish's tail and its front extremities have turned into flippers.

The dolphin and seal are also shaped like fish. That's why they are all excellent swimmers. The whale can outrace even a steamship.



FISH CHAMPIONSHIP

A fish tapers towards its tail. Its body is streamlined and smooth, enabling it to slip through the water without losing speed. That is why the fish have become the masters of the sea. They are the fastest swimmers.

Herring

RUDDER ON TAIL

The tail flukes are both the motor and the rudder of a fish. You can tell from them where a fish feeds. In the mackerel and tuna, the two flukes are alike. They therefore can have board and lodgings everywhere.

Tuna

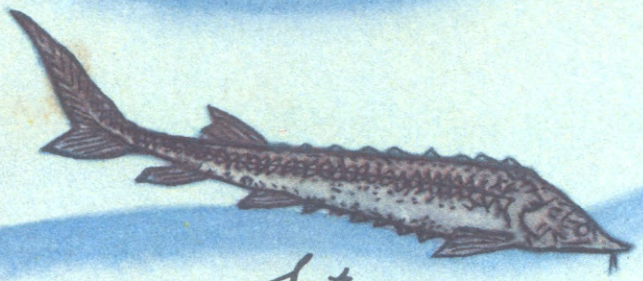
KEEL ON BACK

What the keel does for a boat the dorsal fin does for a fish. It is the means by which the fish maintains direction.

Haddock

HORIZONTAL RUDDER

The sturgeon swims snout downwards when it searches for prey on the sea-floor. It uses the upper fluke of its tail more often than the lower. That fluke is therefore longer.



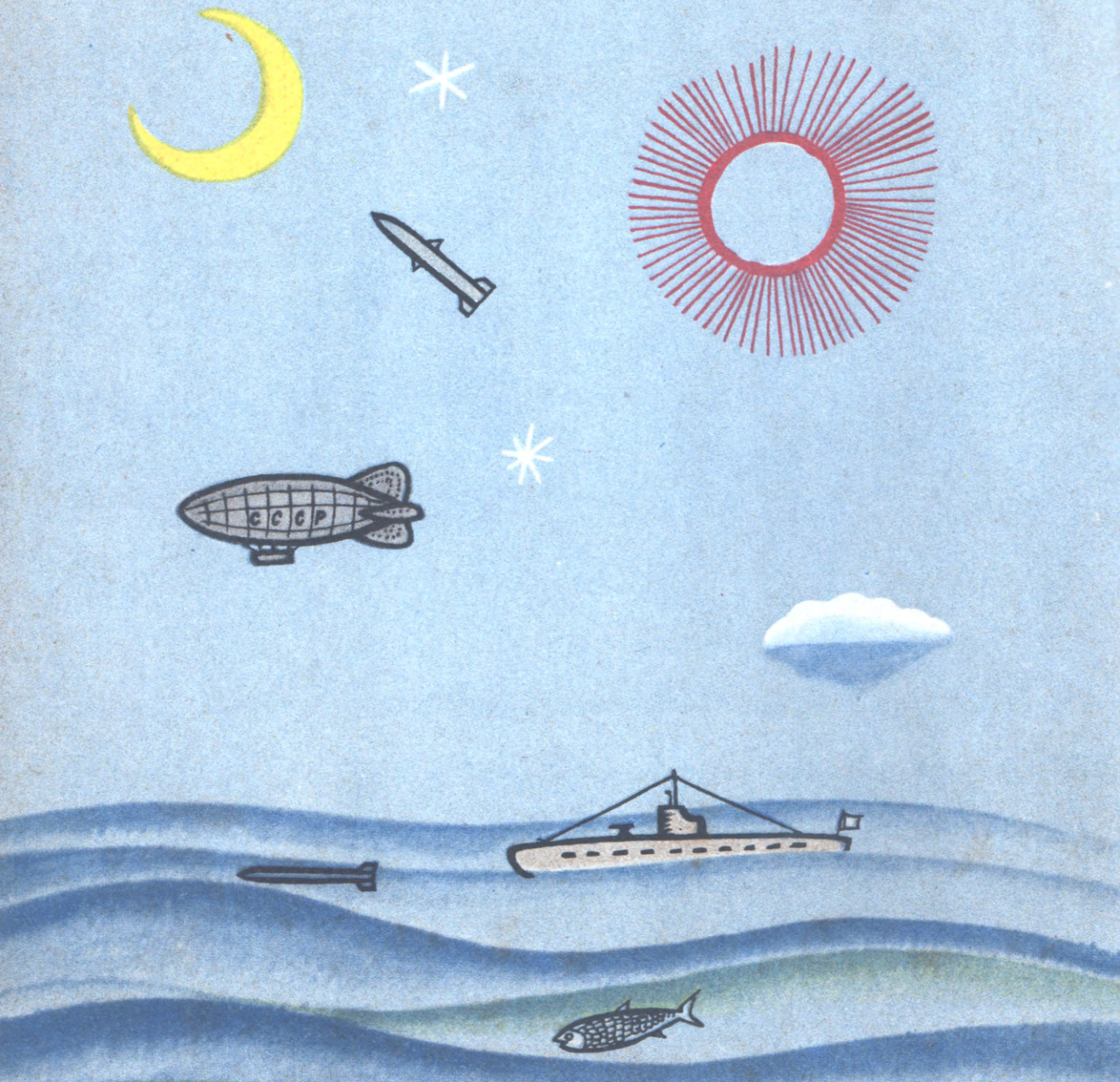
Sturgeon

WINGS

In the flying fish, however, which feeds on the surface, the lower tail fluke is longer. In flinging itself out of the water, the fish uses the lower fluke as a sort of propeller.

Flying fish

And now use these drawings to write a story about what man has borrowed from fish. Don't forget, however, that man has done something more than borrowing – he has equipped his ships and planes with motors which make them move faster than fish and fly faster than birds.



"But we shan't let them, shall we?" said Maya in a trembling voice. "Why do we have no gun?"

"What if we charge them at full speed and scatter them?" I suggested.

"Let's try," the captain agreed.

We forged ahead so fast that the wind whistled in our ears. We were carried away by the chase and nobody saw Keepmum run to the ship's side in an attempt to recover his cap which had been snatched off by the wind.

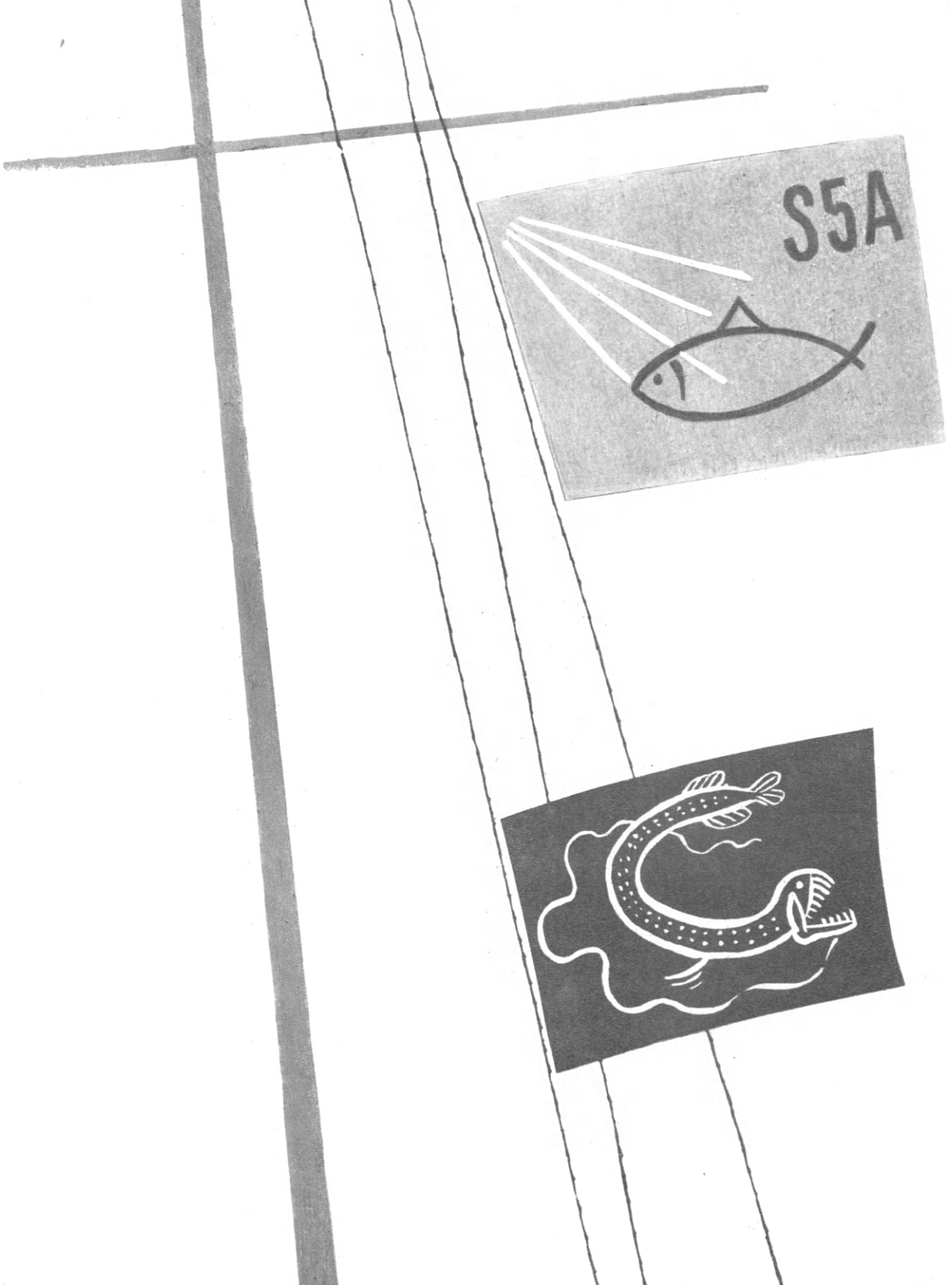
"Look out, Keepmum!" shrieked Maya.

But it was too late. Keepmum waved his arms but, unable to keep his balance, fell overboard. Our momentum was so great that we swept far ahead before we could turn back to rescue Keepmum. His head bobbed above the water.

"Hold on, Valera, we're coming!" we shouted.

Just then the white crest of a high wave rose above Keepmum's head and—

At this point, the log broke off.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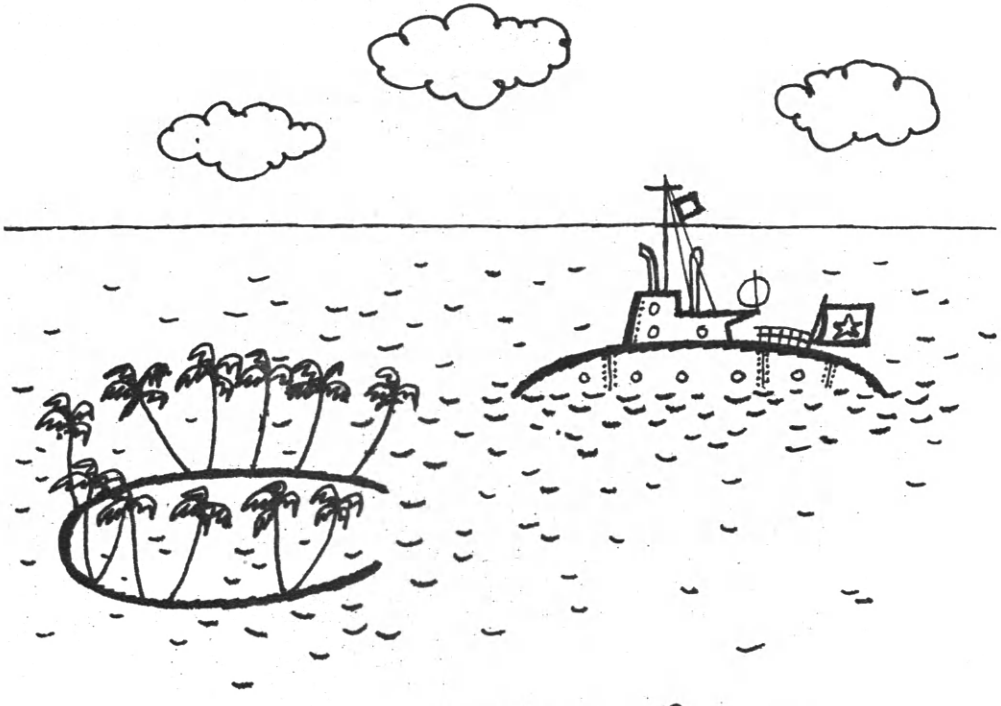


What happened
and
what did not

Diary Concluded

A MEETING IN THE ROADS

Once again brittle snow stars were falling on my shoulders. Over the last three days I had gone into the public garden several times to peer into the children's faces. "Subviewer," I murmured to myself again and again. Was it possible that no one from the mysterious ship was looking for the lost log?

The garden was almost deserted. Through branches fuzzy with hoarfrost I saw two bright spots, a red cap and a blue cap. What were those two girls arguing about?

I stepped nearer.

"Let's go, Katya," said the red cap. "It's no use waiting any longer. We'll be late. We've only half an hour left."

Katya? I pricked up my ears, although the name was common enough to belong to thousands of girls.

"No use waiting," the blue cap echoed. "It was lost because of me. I'm not going anywhere. You can go alone if you like."

I could not see the blue cap's face. She was bending low, writing something in the snow with a twig. She had traced "Subvi—"

"Hallo, Katya and Maya," I said loudly. "No, it isn't lost." I took the manuscript out of my muff.

At first they stared at me in surprise, then they hurriedly unwrapped the roll.

"Hurrah! It's our log! Oh, thank you! But where did you find it?"

"On that walk over there. And now let me ask you something. Is Keepmum alive? Who was the Invisible One? How could Anton Petrovich visit a ship at sea? I think since you're back from your voyage the design of the *Subviewer* isn't a secret any longer and you'll tell me all about it."

"Keepmum's alive," answered Maya. "As for the Invisible One—please excuse us; in an hour Yura's going to read the log at a meeting, but he has only the middle and the end of the log. The beginning was lost, you see. Now that the log's been found we must take it to Yura as quickly as possible. Please come to the school at five. You'll see everybody and learn everything. Here's the address."

I was busy at five o'clock but I went at six, taking Victor with me.

The interval was just over. But the children were still chattering as they took their seats in a hall decked with bunting.

"Pierced the boat with its nose! That's what I call a blow!"

"What pierced the boat?" I asked.

"A swordfish," a familiar voice answered.

I turned round and saw Igor, one of the twins.

"How did you get here?"

"I came with Oleg because they're talking about the sea. It's such a pity Alyosha isn't here. Did you come in just now? You missed a lot!"

We got seats at the back but I had no difficulty in spotting my acquaintances, Katya and Maya. They sat at a table on the stage, beside a tall young teacher. So that was Anton Petrovich. Next

to him sat the little snub-nosed Keepmum. And that boy with the tuft of hair and slightly screwed-up eyes who sat looking gravely into the hall must be captain Pyshkin.

"Go on, Yura," said Anton Petrovich to a dusky, dark-eyed boy who held the log in his hands.

Yura read on.

HOW WE SET FIRE TO THE SEA

The night we almost caught the Invisible One I was on watch. A man on duty must not sleep but I knew that Keepmum was awake too.

The *Subviewer* was sailing in the Pacific Ocean, and far away, in the Black Sea, was Mitya, one of our pathfinders. We were to talk with him over the radio at midnight.

At 22:15 hours I made the round of the ship. As I was passing the mess I heard a rustle and light footsteps. There was no key in the lock, so I put my eye to the keyhole and peeped in. I saw a mysterious shining spot.

"Throw up the sponge, Invisible One!" I shouted, and ran off to fetch Keepmum. "You can't get away!"

When we came back the door was open. The Invisible One had escaped. But he had left his notebook and a retort with sea water in it on the table. It shone with a wan bluish light. It was the light of the sea, a marvellous light without smoke, heat or flame. I had heard about this from Anton Petrovich, so I was able to tell Keepmum about marine luminescence.

Many marine animals are luminescent. A speck of luminescent substance is the tiny torch of the one-celled sea lilliputian, while some fish have glands secreting a luminescent slime.

The "signal lights" of fish are most varied. They have "headlights", lenses, reflectors, and even screens.

In one fish, the eyelid serves as a switch. It has its "torch" on the lower edge of its eye, and by raising its eyelid it puts out the light.

During the First World War Japanese scouts used dried shell fish as torches. They had only to moisten the creatures to get them shining. By that feeble light, invisible to the enemy, the scouts could read or write all they needed on a dark night.

Some marine inhabitants shine with "borrowed" light. The Clio, one of the mollusks, glows after taking its luminescent food. Sometimes salt fish in a barrel begin to shimmer. These are the last flashes of the luminescent bacteria that had settled on the fish.

In the retort left by the Invisible One were two small luminous squids. It seemed as if a skilful needle-woman had embroidered them with luminescent pearls and had even made bead rings round their eyes. But suddenly the living torches began to fade.

"The lamp's going out!" cried Keepmum.

"Come on, light up!" I said, and shook the retort.

The squids began to shine again. A slight shake makes them glow.

Sometimes minute marine animals called peridinians are washed ashore by the surf. When somebody walks over the wet sand at night, the friction of his soles against the sand makes it flash.

In a fairy tale, a tomtit boasted that it would set fire to the sea. I don't know about the tomtit, but certain fish do in swimming "set fire" to the sea. The ship's bow and the oarsman's oar do the same.

"Yura," Keepmum whispered in my ear, "let's go and set fire to the sea."

We took a long pole (besides, Keepmum took a plankton net) and went on deck. The moment we struck the water with the pole we felt like magicians, for the spray flashed like sparks.

When we hauled up the plankton net it shone like a diamond chandelier.

It is true that we were soon fed up with "setting fire to the sea", because we saw that the sea shone even without our help. The night was particularly suitable for it.

It was moonless and as dark as black velvet, with a light breeze. We stood on the deck admiring the undersea illumination.

The number of lights floating in the water! At one moment they zigzagged like lightning, then flashed in a chain, or shimmered like stars. Jellyfish tossed on the water like varicoloured Christmas-tree globes. The wind snatched the shining foam off the waves. A large fish flashed by like a comet, with a long fiery tail trailing behind it.

"It was on a night like this," I told Keepmum, "that a captain's hair turned grey."

SHINING TRAIL

Yes, it happened in war-time. The captain of a ship tracking enemy submarines saw twice during the night a shining strip draw near his ship's side. His hair turned grey when he thought that his ship might be torpedoed. The strange light was the fiery trail of a dolphin.

This sort of error has occurred often enough since ancient times, in war and peace alike. Undersea illumination misled Columbus. On the last night of his voyage he saw lights far off and rejoiced. He thought somebody on the shore was signalling him by raising and lowering a candle. Yet the ship was too far from land to see a signal. Scientists believe that Columbus' "candle" was a sea and not a land light.

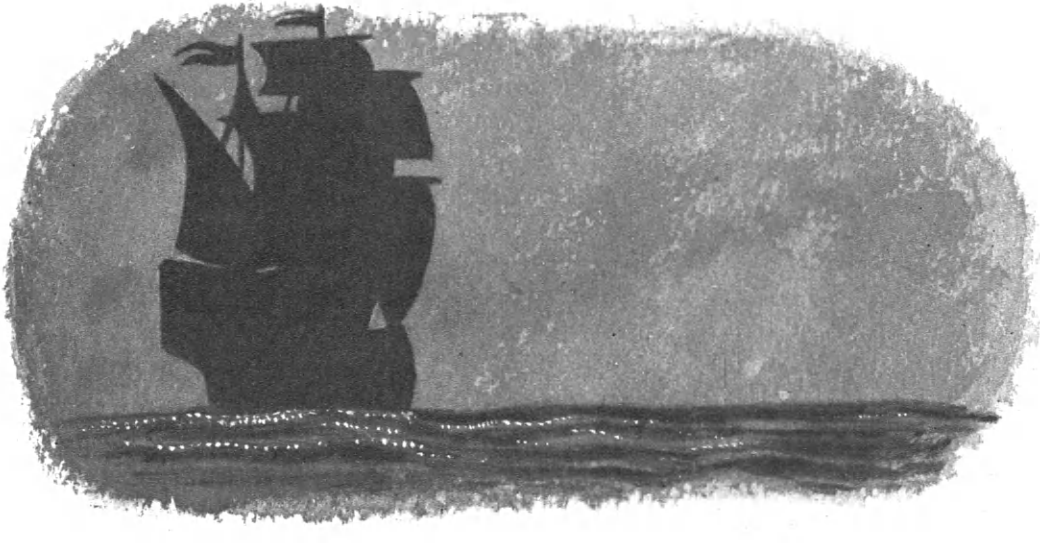
Captains, naval pilots, artillerymen and fishermen must all know about those unusual lights, which can betray, help or mislead. Among

our fishermen are excellent scouts who track fish by the light they radiate. A scout with keen eyes peers into the night sea. When he sees a light moving under water he must be able to tell from what fish it comes and at what depth it is moving.

Underwater lights are fish signals. Some of them seem to say "Keep off" and others, "I want to meet you". The constellation of lights emitted by minute shellfish look to a school of herring like the shining signboard of a floating restaurant where they can get a square meal. Seasoned fishermen catch herring "by phosphorus", that is, where bright spots show on the water at night. Herring come to those spots in search of food.

Man uses even more cunning methods to decoy fish. Sometimes there is a shining advertisement but no food at all. An electric bulb lowered into the sea lures herring into the net. Professor P. Borisov of the Soviet Union has done a great deal to improve flare fishing.

Our fishermen today use light to lure Crimean anchovies, scad, sardines and other fish.



"Yura, I want to do some flare fishing," Keepmum spoke up.

"Not likely! You'd fall overboard and scare everybody stiff. Besides, I must go to the wireless cabin."

Keepmum followed meekly in my footsteps. But what was that? We heard a suspicious knock and a cough behind the wireless cabin door. Was the Invisible One hiding there?

I winked at Keepmum and threw the door open. Sitting at my wireless receiver was the captain himself, drumming the table with his fingers.

DOUBLE BOTTOM

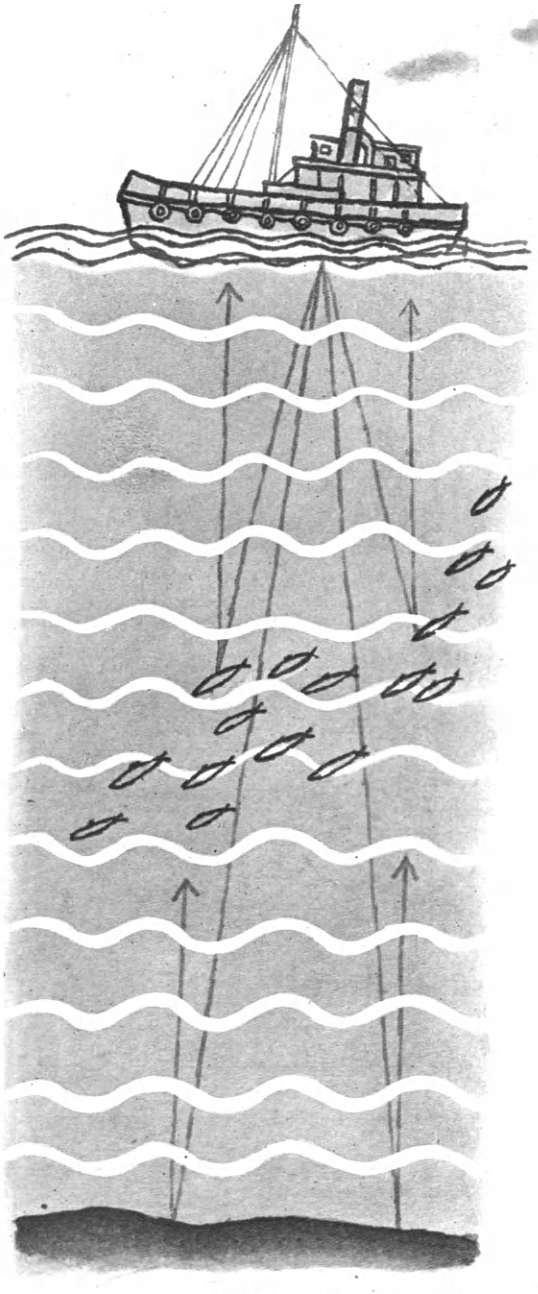
"Why aren't you in bed?" I asked, sitting beside him.

"I can't sleep," he answered sullenly. "How could I? We're sailing in the Pacific now, among coral reefs. We may run aground or become shipwrecked. I'd pinned all my hopes on the echo-sounder, but either our 'sea ear' is no good or the Pacific has a double bottom."

A double bottom! I jumped up. What poppycock! Now I could accuse the captain of ignorance. Double ignorance. He must have forgotten how happy we had been because our ship, like other Soviet ships, was equipped with that wonderful instrument, the echo-sounder.

In the past, a sounding line was cast into the sea to fathom its depth. Nowadays the sounding is done by an invisible diver who is swift and dependable. Sound itself does errands for man.

Vibrators placed under water emit sound waves. The time when the sound signal is sent out on reconnaissance is marked. It travels in water at 1,500 metres per second. It speeds farther and farther down until it comes up against some obstacle, usually the sea-floor. The sound waves are reflected back from the sea-floor and caught by the "sea ear", the listening device installed in the ship. It takes less than



one minute for the report to arrive. Once the velocity of sound and the time when the sound wave was sent and received are known, the depth under the ship's keel can be calculated.

Moreover, if the echo-sounder is equipped with a registering device, the sound wave will submit a written record of its journey—its pen will trace the outline of the sea-floor on a running tape

Velocity of sound is 1,500 m/sec
Time is 4 seconds
What is the depth?

"The 'sea ear' can't have made a mistake!" I cried hotly. "I bet my own ears!"

"Keep them ready," Slava sneered. "I knew you wouldn't believe me, so I've brought the proof."

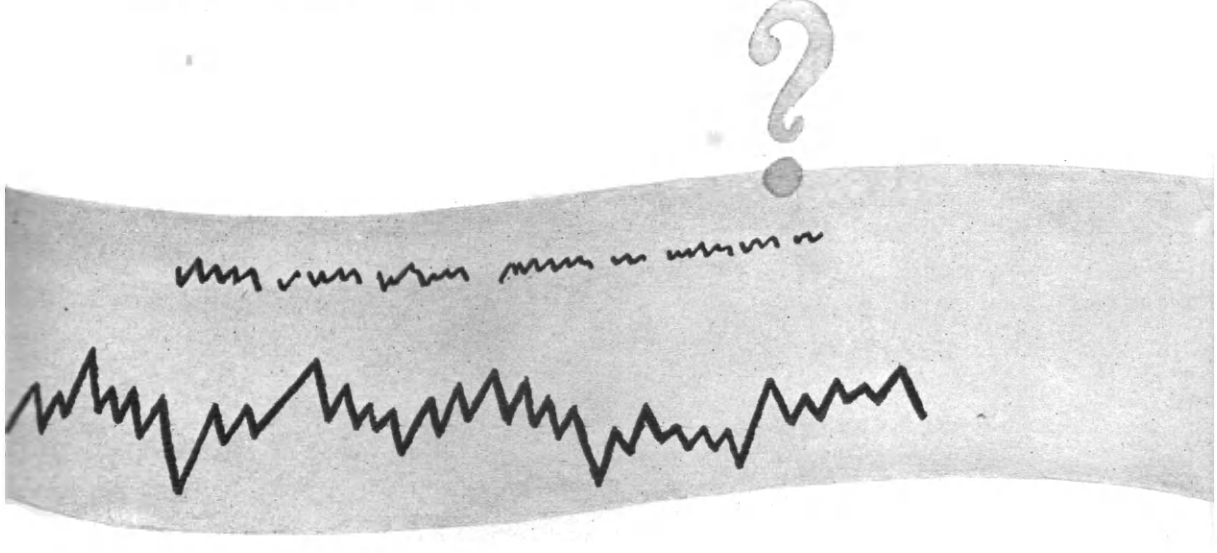
The captain took out of his pocket a length of tape from the reel of the registering device. I looked at it and felt sick. On the lower part of the tape was the jagged line of the sea-floor traced by the sound wave. But above it ran the zigzag of a second line, a shorter one. It did look as if the Pacific really had two bottoms here.

What had happened to the "sea ear"? And what was going to become of my own ears? But Keepmum helped me out.

"It's two past one already," he said with a yawn. "Mitya must be awfully cross with us."

"You may keep your ears," said the captain. "Let's hear what Mitya has to tell us about the Black Sea."

He sat down at the wireless.



1) 1,500m × 4 sec = 6,000m
2) 6,000m ÷ 2 = 3,000m

Answer: 3,000 metres

A CONCERT BY THE MUTE

At school Mitya was well known for his pranks, and now he began his broadcast with a joke.

"Schoolmates," he said, "I warn you that today I'm not just your schoolmate, Mitya of form 5A. I'm a compere at a concert of the dumb, or rather of those who are unjustly considered dumb. You will hear their voices in a moment. The programme opens with a choir, which is gay and well-knit despite the absence of a conductor. Attention, our unusual concert is about to begin!"

We heard sounds like the chirruping of birds. A strange choir! Was something wrong with my earphones? But the captain and Keepmum wore the same puzzled look.

"You've just heard a drinking-song," Mitya went on unperturbed. "The next item is a marching tune sung by another choir."

After the march, which rose and fell like a soughing wind, Mitya announced a soloist who would play an instrument never before used by a musician. It wasn't hard to believe that. We heard a most unmelodious crack. It was as if a jar had burst.

Was Mitya just having a lark with us?

"Not a bit," said Mitya, guessing our thoughts. "You heard an underwater concert broadcast from the Black Sea. If you don't believe it I can name the performers. The first choir was a school of feeding herring and the second a school of sprats on the move. The soloist was the Alpheus, a crustacean. And the instrument it played was its own nippers.

I'll bet you never heard such a concert before. But where's the applause, friends? Let's clap our scientists who arranged this concert. They recorded fish's voices on tape and so proved that the sea isn't silent."

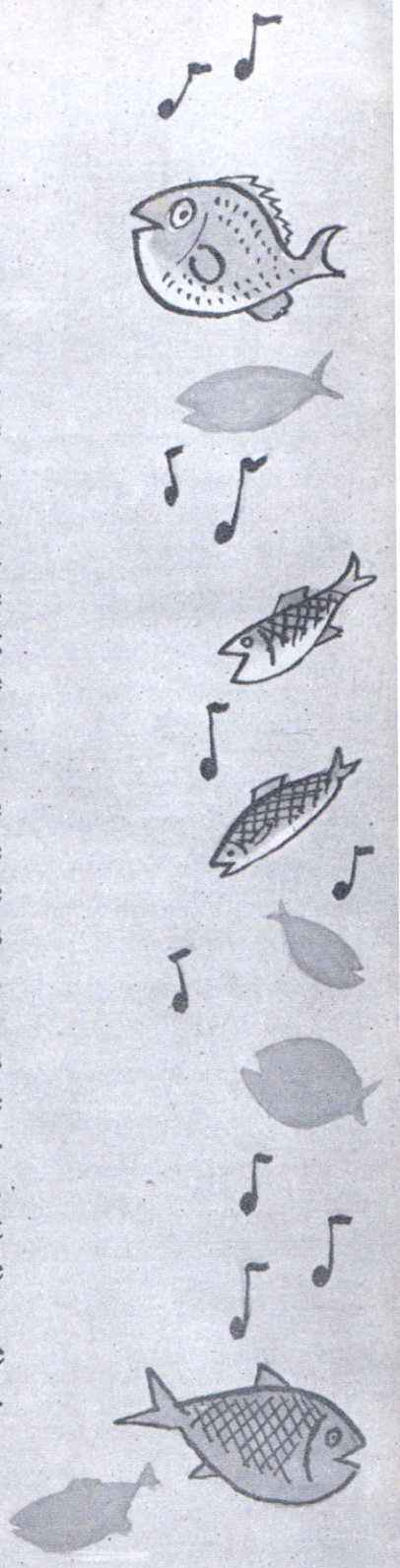
We, the audience of the unusual concert, greeted Mitya's words warmly. Keepmum was so delighted that he stamped his feet.

"The ancient Greeks had a myth about sirens whose singing was heard by seamen," said our invisible compere, after a moment's pause. "Certain scientists interpret that in their own way. Those who sail in southern waters sometimes hear fairly loud and melodious sounds made by a large fish called the drumfish. It may well be that the myth of the singing sirens was suggested by that fish's voice. In those remote times it was hard to believe that man could hear the voices of fish.

"But some fishermen living on the shores of the South China Sea can distinguish under water the voices of marine inhabitants. They say that the silver bream has a jarring voice, while the ray's is pleasant and that the jewfish, when in a shoal, crackle like rice frying in a pan.

"Such fishermen are called 'listeners'. Usually boats wait for directions from them. A man dives into the sea and listens for half a minute. Then he rests holding on to the boat's side. Again he goes under water. The fishermen wait. At last he indicates the spot where the most important fish conversations were heard and the net is cast there.

"But the best listener is an instrument called the sonar. It's used by many of our Black Sea fishermen.



It brings the sounds of the fish choirs to them, telling them where they can haul in a good catch.

"And what if a dense school passes under the bottom of a ship using an echo-sounder? In that case the reconnoitring sound wave does not reach the bottom. It is reflected by the fish's backs. And the register traces a second line on the paper. However, an experienced captain can distinguish between the short and feeble line of the false bottom and the lower jagged line of the real bottom."

"That concerns you, inexperienced captain," I said, giving the hushed Slava a nudge. "Getting into a panic, saying the Pacific has two bottoms!"

"All right, stop talking. Let me listen."

"This is the end of the underwater concert broadcast from the Black Sea," Mitya announced. "Science has made the 'dumb' talk. By means of a fish locator our fishermen can distinguish the voices of more than a dozen food fishes. But this is only a beginning. We'll hear many new undersea voices yet."

On the ship's deck next morning the captain and I eagerly told the girls about the Black Sea concert.

Keepmum, who had been listening in silence, suddenly asked a question.

"Why didn't you tell us about the shining trails, Yura?" he said. "Didn't you think we'd be interested?"

It was only then that I recalled the retort left by the Invisible One. I must show it to the girls. I rushed to the mess.

The notebook lay where it had been, but the retort was gone.

Should I tell the others about it or shouldn't I? However, when I got back on deck nobody asked me whether I had found the retort.

Everybody was peering into the distance where an atoll had come into view. The atoll is a coral island looking like a ring sawed through. Inside the ring is a greenish lagoon and outside lies the blue ocean.

"It looks like a stone belt thrown away by a giant," said Katya. "There's the belt, but I wonder where's the giant."

THE BELT OF THE DROWNED GIANT

The time has come at last to tell the story of an amazing fortress put up by builders who die from muddy water. This fortress which may be miles high grows by itself. It stands on skeletons. Ships tie up at its walls.

It is called a coral island when it rises above the water and a coral reef when the ocean surges over it.

Such fortresses are erected by colonies of corals, builders who have neither hands nor eyes. A coral is like a flower. But it's not a flower. It's an animal called a *polyp*. And what seems to be its petals are tentacles for catching plankton.

The polyp builds by extracting lime from the sea water to make its own skeleton. When it dies the skeletons become the "bricks" from which the walls of a coral fortress are built.

The number of builders grows as the construction makes headway. New polyps grow, like the branches of a tree, out of the swelling buds on the sides of the old polyps. A coral colony may grow by eight centimetres in a year. Think how many thousands of millions of little stonemasons must have taken part in the construction of the Great Barrier Reef off the Australian coast, a wall 2,500 kilometres long!

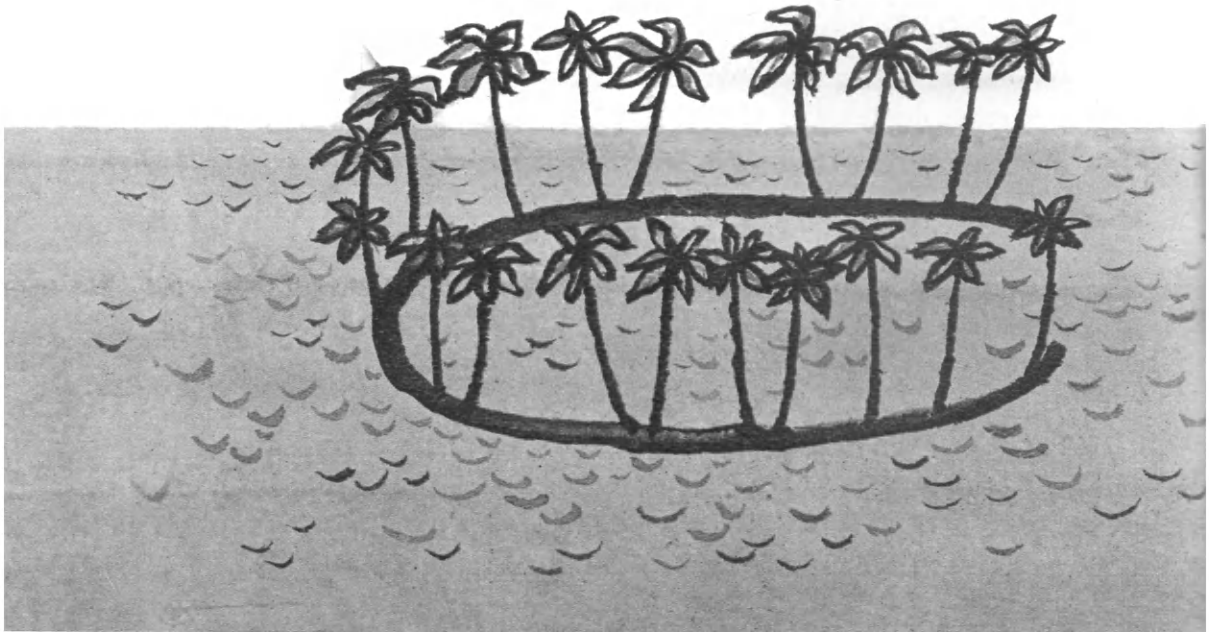
Before the days of ships the chain of coral islands helped man to get far out to sea. In a frail boat he could make his way from island to island and settle in new places. A constant trouble was the lack of fresh water on a coral island. To quench their thirst, people had to drink the milk of unripe coconuts and the dew collected on palm leaves.

Nowadays many coral structures serve as hydrodromes for aircraft. Like Katya, many a flyer must have asked himself as he circled over a hydrodrome why an atoll looks like a stone belt discarded by a giant.

This question set Charles Darwin thinking as long as a hundred and thirty years ago. At that time he was a young naturalist sailing round the globe on the *Beagle*.

The *Beagle* came across many atolls. Soundings made at Darwin's request showed that on the ocean side the walls of the coral fortresses were miles deep. Yet corals can live and build at no greater depth than fifty metres (160 ft).

Darwin succeeded in solving the mystery. He proved that at one time there had been a rocky island where an atoll lies today. The island had gradually sunk into the water, but it had sunk so slowly that the corals surrounding it in a ring had had time to build new storeys. While the island sank the corals were growing upwards. Therefore, when the island "giant" disappeared under the water, his stone belt was left behind.



But why is an atoll like a ring sawn through? Why is the stone belt unbuckled? It was "unbuckled" by muddy water. The marine stonemasons can live only in salty, clear and transparent water. When river water, muddy with sand and filth, comes in, the sea water freshens, corals perish and the ring opens.

I must confess that when telling the girls about the origin of coral islands I didn't say that I had only just found out about them myself, from the notebook forgotten by the Invisible One. It's because the attention with which they heard my story was very flattering.

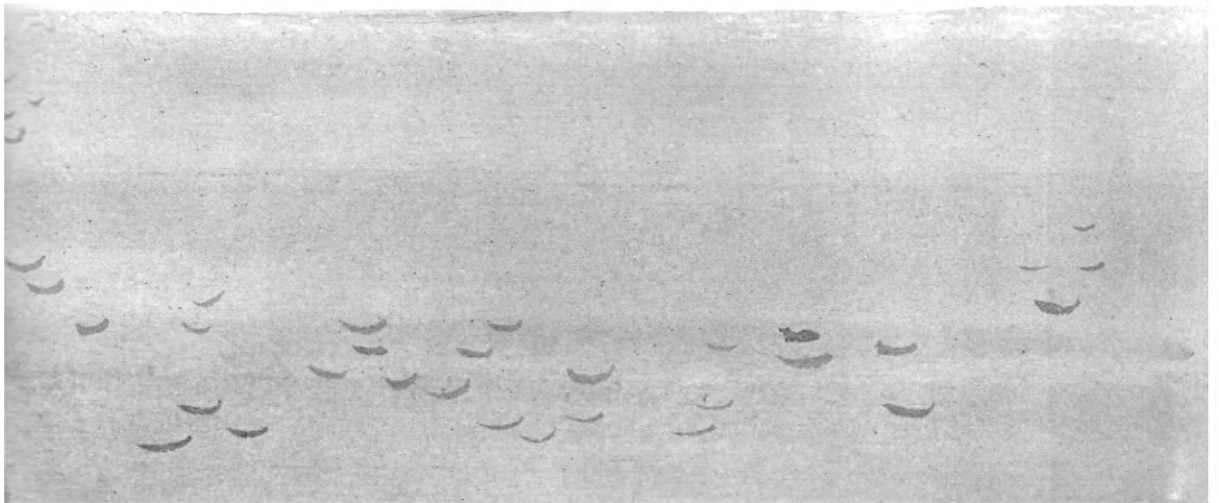
"Would you like to be guide on a coral fortress?" asked Maya.

"I'll try," I answered modestly. "But how are we going to land on the island?"

"From a boat," grumbled the captain. "I can't risk sending the *Subviewer.*"

The captain couldn't risk sending himself, either. Keepmum had toothache. So it was Katya, Maya and I who rowed to the fortress.

Only some tropical birds perched on palm trees took notice of our arrival. There was not a soul to be seen on the atoll. All around us



surged the ocean, while the white coral sand crunched underfoot, a sand so dazzlingly white that looking at it without sunglasses hurt our eyes.

We had taken diving suits with us but, to tell the truth, I didn't feel like diving into the lagoon. I glanced anxiously at Katya. She sat down on the sand and started putting on her flippers.

"There may be sharks in the lagoon," I said cautiously. "Aren't you afraid?"

"Of course I'm afraid—I may scare them away," Katya laughed. "After all, Italian divers say sharks are very cowardly. But I see you'd better stay here on the beach with Maya. I can survey the coral fortress alone."

Could I let a girl show me up like that? I put on my diving mask and flippers and dived into the lagoon to overtake Katya.

CORAL FORTRESS

That's when our adventures began. I overtook Katya trying to decide whether to break off a pink, red or violet "stone flower" from a growth of coral. I knew that the polyp's tentacles are armed with stinging cells and that some corals burn your hand like red-hot metal. I warned Katya by sign which meant: "Don't touch it. You'd better not. That 'flower' may sting your hand so badly—"

Katya obeyed, strangely enough. She even agreed to keep by my side.

Together we swam slowly along the living wall bristling with branches. The wall moved its countless tentacles—the coral family was having a meal, and also giving one.

We shooed away a small school of motley parrot fish. They had already done considerable damage to somebody's undersea home.

These grey-violet fish adorned with red spots may be called "wall-eaters". They bite off coral branches, swallowing the polyp's soft flesh and spitting out its skeleton and lime crumbs. It is of these crumbs—the remnants of destroyed corals—that the white coral sand is composed.

A long-legged crab we'd frightened darted into a thicket of red-violet stalks. I looked closely at the shrub hiding the crab and recognised a famous red alga.

Coral fortresses are a construction job involving the whole ocean. They are built not only by polyps but by a multitude of marine inhabitants, both living and dead. Mollusk shells, the remnants of crabs' shells, the needles of sea urchins, the calcareous tubes of worms, the skeletons of fish and sponges are all perfectly suitable building materials. The waves would have carried them off but for the red algae, which holds the "bricks" together, stopping the holes in them, and in restless waters completely and solidly encrusting the structure with lime.

"The best marine plasterer," I introduced the alga to Katya with a bow, and then forgot it. Looking at the coral fortress, I began to think of those shut up alive in its walls.

There are both builders and demolishers in the sea. Numerous occupants of the fortress do nothing but bore into and destroy the house sheltering them. Sometimes the corals wall up the passage bored by the tenants. Then the trapped borers are bricked in alive. In broken coral people have found the giant clam called Tridacna gigas, the fist-sized Coralliophila snail and small crabs, life-long inmates of the coral prison.

Suddenly Katya began to make signs that I, knowing her character, understood easily.

"Yura," she was saying to me, "let's drop into an undersea flat, shall we?"

There are millions of "flats" in the coral fortress. Crevices shelter worms, trepangs and shellfish, while sponges cling to projections. But the most fearsome tenants hide in clefts, from where the arms of an octopus may suddenly be thrust out or a moray may glide forth. This rapacious fish, three metres long, has such terrible teeth that it cannot even shut its mouth. And what's more, its bite is poisonous.

"What if we meet a moray?" I said to myself. It was as if I had made a prophecy.

It was coming, the man-eating fish which looks like a fat spotted snake. Its gaping mouth and bared teeth were threatening us. We had no weapon.

I pushed Katya aside and rushed ahead to divert the moray.

Suddenly I saw the moray's head pierced by a harpoon. The moray floundered in its death throes, thrashing about with its tail. Then it began slowly to sink.

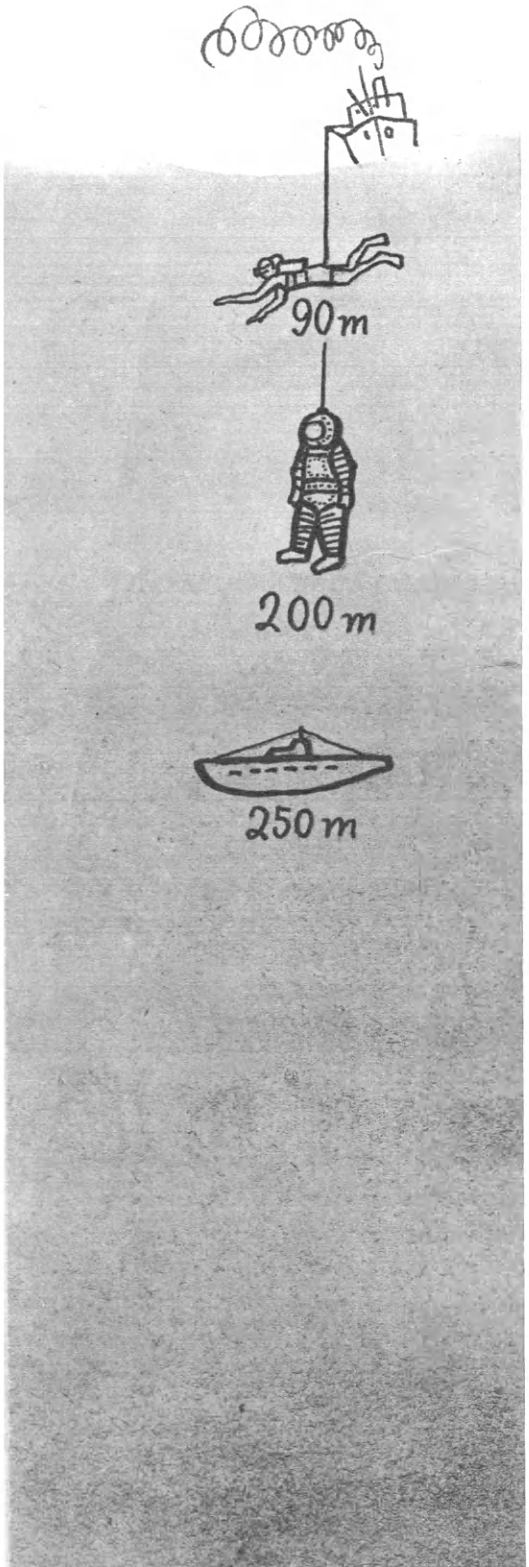
I hardly remember how we swam back to the boat. Maya's eyes rounded when we told her.

"How terrible!" she whispered. "But who rescued you? Who killed the moray? Did you see who did it?"

No, we hadn't. We had only seen the harpoon cutting through the water. And we all came to the unanimous conclusion that it was the Invisible One who had rescued us.

After that our Katya became so quiet that she was not like her former self. But it didn't last long. When the boat was approaching the *Subviewer* Katya cheered up and said she would continue to take part in the most dangerous adventures.

But she never had a chance.



A DEEP-SEA FILM SHOW

I could have guessed it. I certainly could. At least on the last day when Anton Petrovich called me to his side and asked, "I hope you've got everything down in the log, Yura. It's important that it should be in perfect order."

I know now he didn't say that for the fun of it. But I didn't know then. My head was full of something else—a deep-sea film show.

It is true that a diver walks on the sea bottom, but the bottom isn't level —it may be a hundred metres (328 ft) deep at one place and a thousand metres at another. Up to two hundred metres it sinks gradually but beyond that it goes down steeply.

Ninety metres is the depth limit for a man with an aqualung and two hundred metres for a diver in a rigid diving suit. That is as deep as anyone can go. Those who ventured farther down would be crushed flat by the water pressure, which increases with depth. A thousand metres down man's body is pressed by a water column weighing two thousand tons. To go deeper, man must use a special apparatus capable of withstanding enormous pressures.

Two Americans, Beebe and Barton, descended to a depth of more than a thousand metres in a bathysphere, that is, a thick-walled metal globe.

In 1953 Auguste Piccard, the Swiss who invented the bathyscaphe, observed marine life at a depth of 3,150 metres.

A year later that record was broken by Captain Georges Houot, a Frenchman. He went down 4,050 metres in a bathyscaphe and recorded in his log: "At last man has seen the sea-floor."

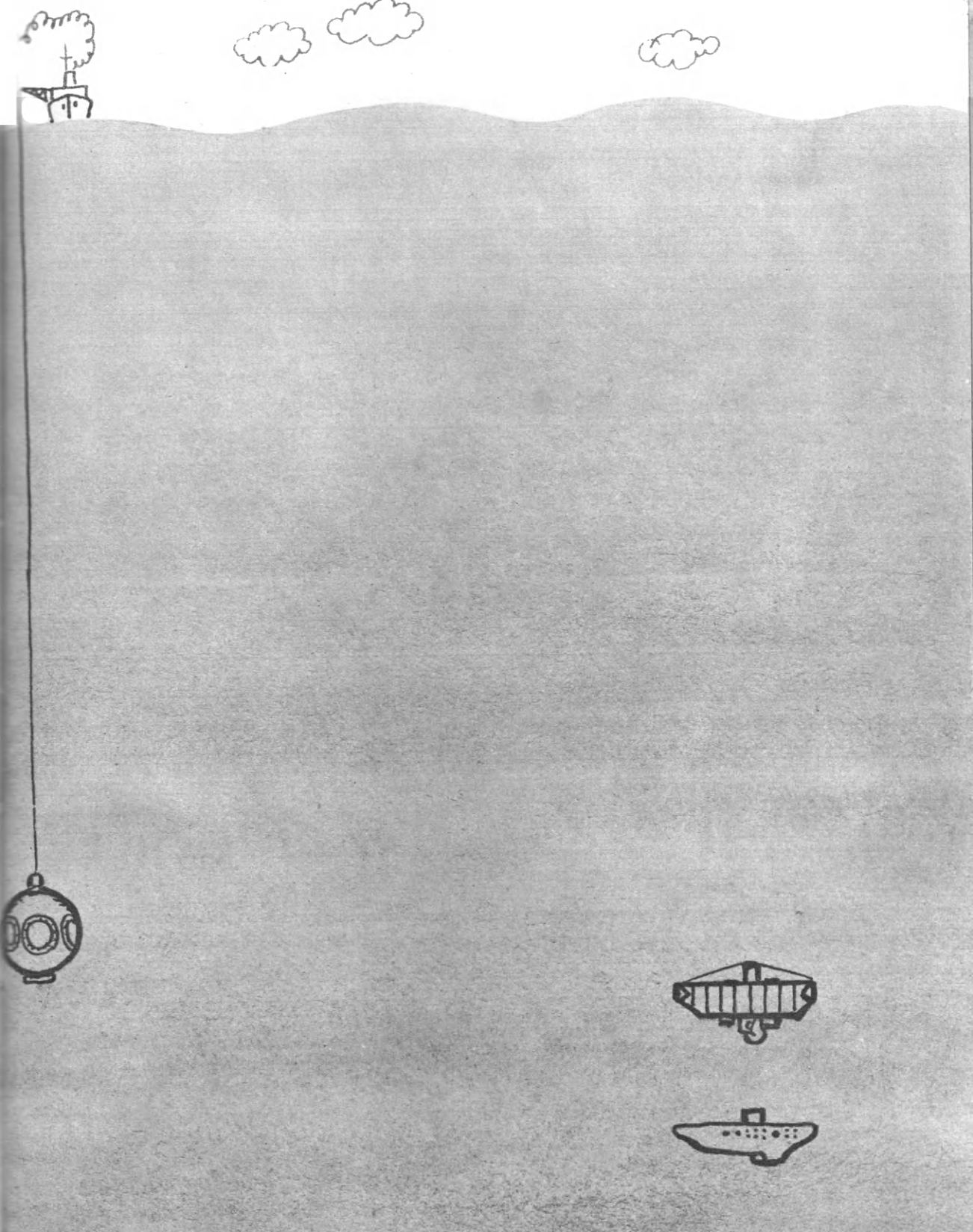
But the last word was spoken by Jacques Piccard, Auguste Piccard's son. In January 1960 he descended in the bathyscaphe *Trieste* to a depth of 10,919 metres, reaching the ocean-floor at its deepest spot, the Mariana Trench.

The human eye has seen marine inhabitants at great depths and the human hand has touched the ocean-floor. That is, not the hand itself but a dragnet on a steel line that can open and close at a desired depth. The drag was lowered from the Danish ship *Galathea.* How the scientists rejoiced on examining their catch! It included sea lilies, sea cucumbers, shells and tiny white actinians hauled up from a depth of 10,190 metres.

Soviet scientists brought up an even more amazing deep-sea catch. The drag lowered from the Soviet ship *Vityaz* scooped from the ocean bed animals never before seen that lived in tubes up to half a metre long. These animals were named pogonophores.

The question whether there is life in the sea depths, about which scientists had long argued, has now been answered. And it was not for nothing that Soviet scientists objected to the American proposal to dump radioactive wastes into the ocean trenches. It would be a crime against mankind to turn the bottom of the Pacific Ocean into a nuclear dump. The ocean depths are not a desert but are inhabited by living creatures.

It was the tenants of the lower storeys of the ocean that we, the crew of the *Subviewer,* wanted to meet.



Anton Petrovich and Keepmum, his assistant, assured us they would telecast a new colour film about life in the sea depths for us.

We turned off the light and sat in front of the screen. The deep-sea film show was on.

Last year when I was staying in Moscow my aunt took me to the University to see its tall buildings. While we waited for the lift, which was coming down from the twenty-third floor, I watched the figures 22, 21, 20 flash on the glass panel on the ground floor. The numbers indicated the floors which the lift passed as it came down.

But here darkness signalled to us. How did we know we had descended into a lower storey of the sea? By fading colours and the disappearance of sunlight.

The red rays disappeared first and then the orange rays. We found ourselves on the "green floor".

"The blood of a fish killed at this depth seems green," said Katya, recalling deep-sea fishing.

"Ugh! Green blood!" said Slava with a shudder.

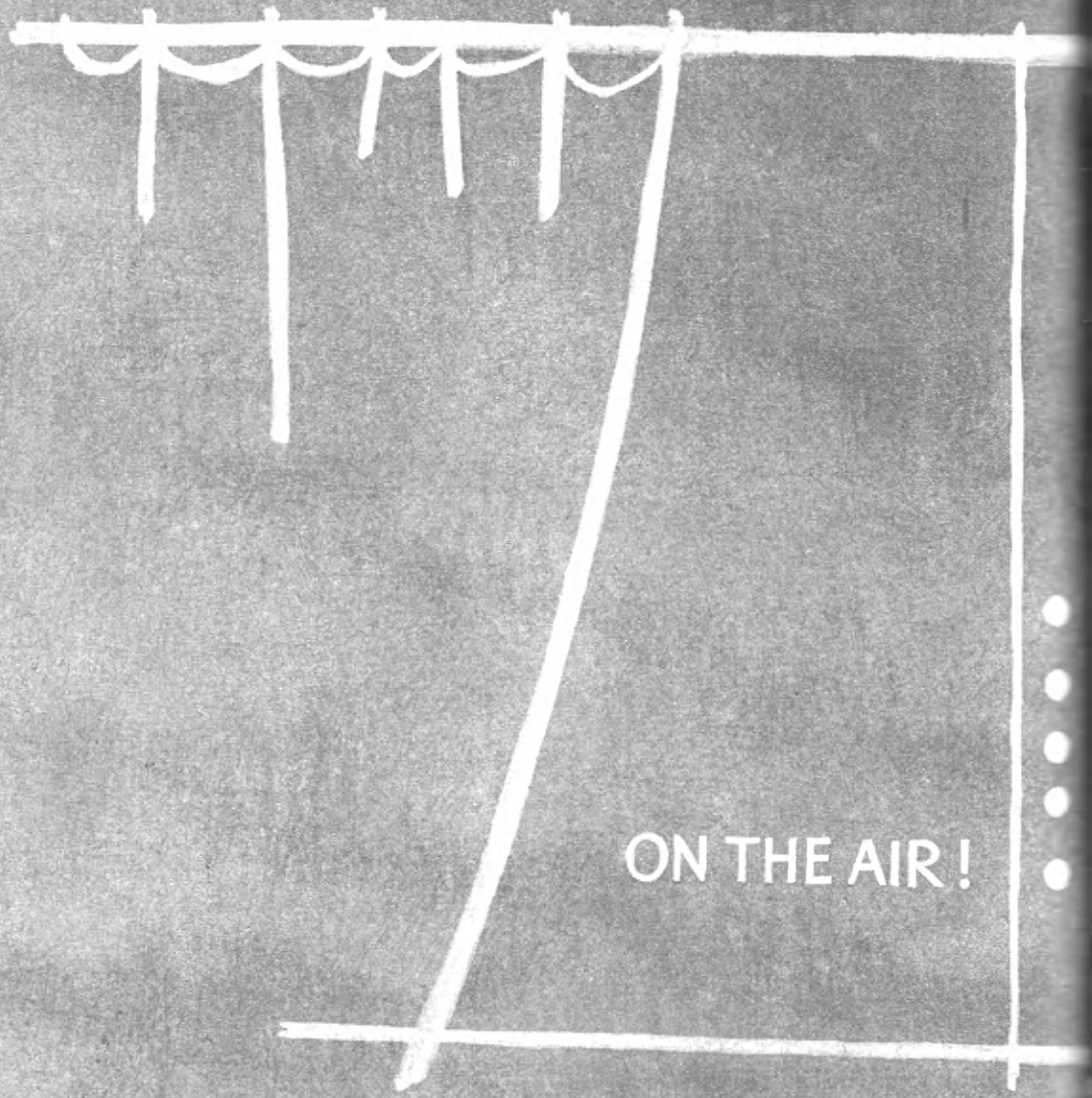
Meanwhile our TV eye was taking us farther and farther down into the ocean.

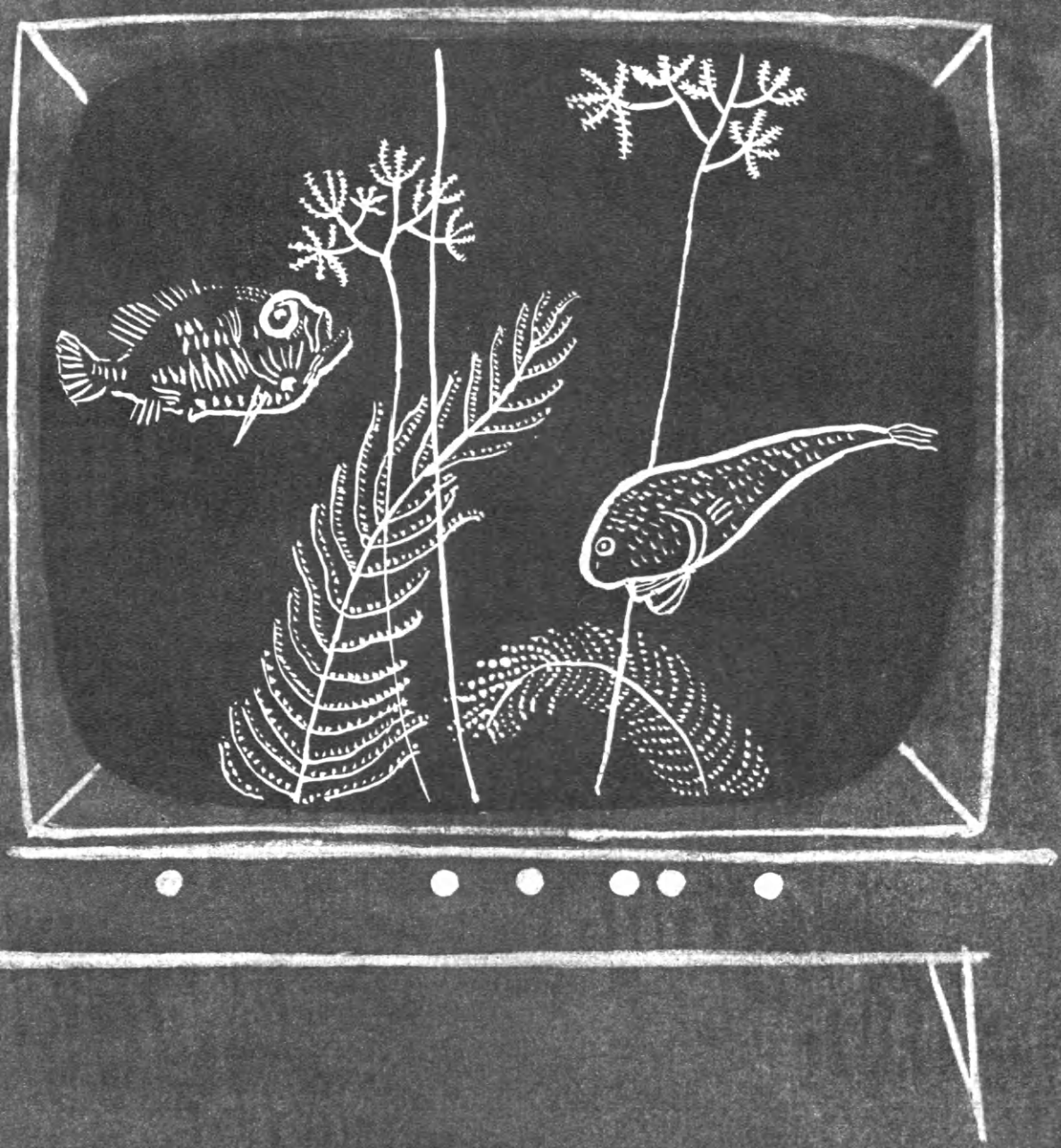
"Good-bye, sunlight," whispered Maya when we had descended to the "grey-blue floor".

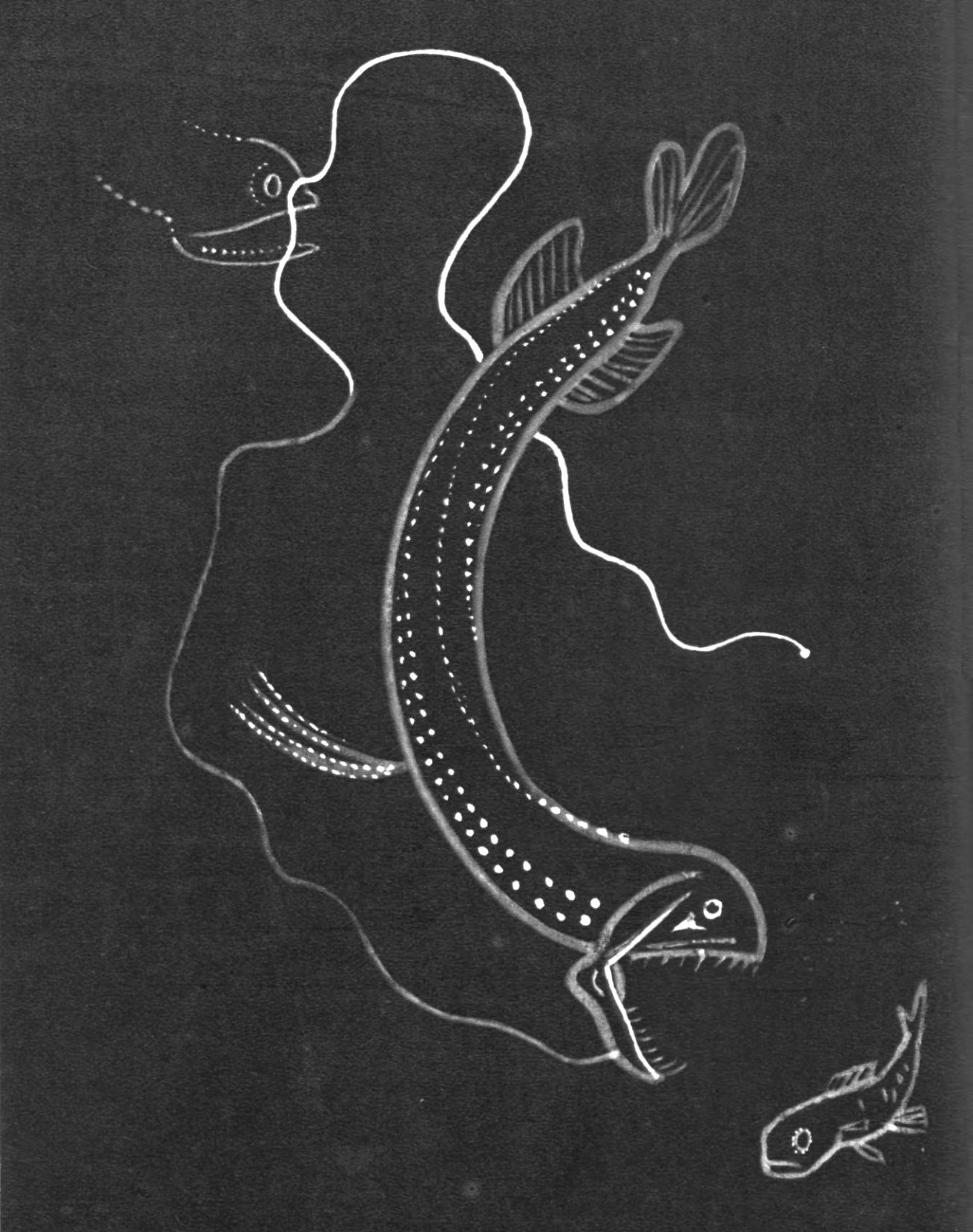
We had crossed the underwater boundary of sunlight and with it the boundary of the green world. Plants cannot grow where no sun-ray penetrates. We said good-bye to vegetation.

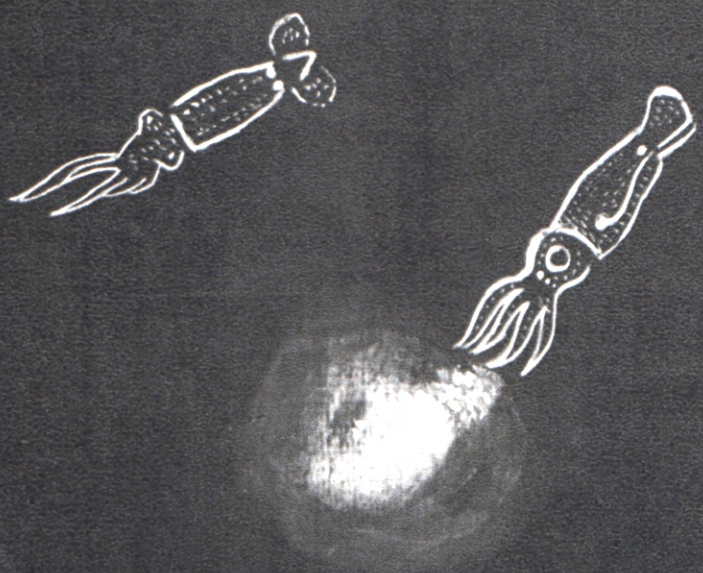
TENANTS OF THE "BLACK FLOOR"

Our TV eye was already searching a new storey, the "black" one. Neither sunshine nor wind ever reaches as far down as that. There is everlasting stillness in that glassy, motionless water. It is criss-crossed only by prowling carnivores and scavengers, eaters of the corpses that settle on the bottom.


ON THE AIR !







The tenants of the "black floor" live by a special calendar, one without spring, autumn, summer or winter. In the sea depths, the temperature is always the same—1 or 2°C. The tenants of the "black floor" have no idea of morning or evening. They are surrounded by a night that will never end.

But we saw lights in the darkness. These were living stars, creatures of the deep sea.

A fish with shining dots along its belly flashed across the screen. It shone like a ship with portholes.

A skull floated out of the darkness, that is, we saw only the skull, because the transparent, jelly-like body merged with the dark water. From it we learned that a fish's torches can light up only part of its body. But still we jumped when somebody's fiery eyes fixed on us, eyes that seemed to be wandering all by themselves. Nor could we help crying out in surprise when we saw a wide-open, shining mouth. We couldn't see the sea monster itself—only its shining teeth. The creatures we managed to take a good look at were not exactly beautiful.

"It must have rickets," said Maya, meaning one of the sea monsters with a pug-like snout.

Maya was right. Deep-sea inhabitants cannot extract lime from the water, and the mollusks living there have thin, fragile shells and the fish, soft bones. There are quite a few other reasons for deep-sea rickets. There's no sunlight and no vegetation, and in general food is scarce. We saw this from the greed of a black swallower which appeared on the screen just when it was trying to swallow a fish three times its size.

"You can't do it! You'll burst! See that you don't choke, you greedy brute!" the girls jeered.

But it did not burst or choke. It swelled like a rubber balloon and to our surprise, the big, long fish found itself stowed away in the predator's stomach. As a result, the glutton became as round as a ball.

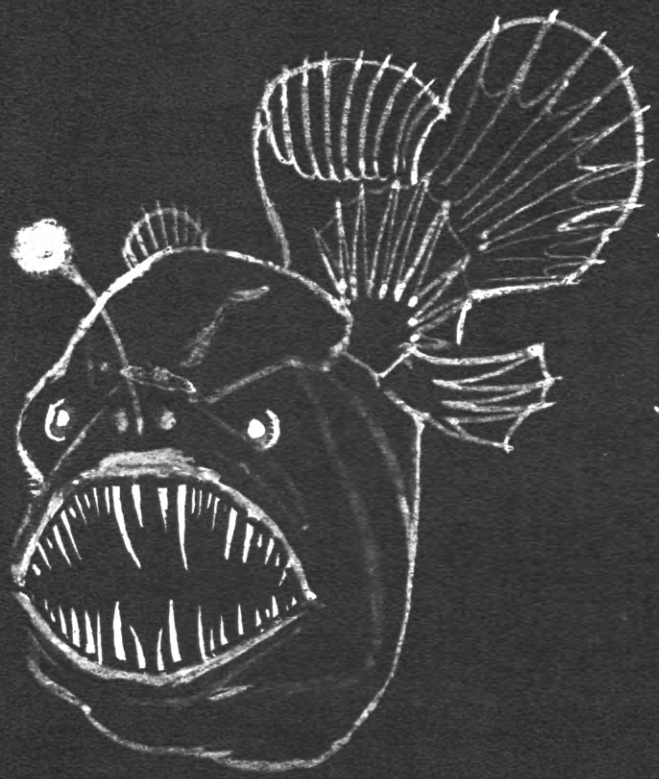
"Well, well!" was all the captain could say.

Meanwhile our TV eye had many other surprising things in store for us. We saw two completely eyeless fishes swim slowly past. These blind creatures feel for their prey with long, thin ray-like fins.

When the blind fishes had gone the screen was left blank.

"Something's gone wrong, I think," said Slava, and walked over to the TV set.

Just then the screen flared up with a fiery-red light so bright that the captain started back.

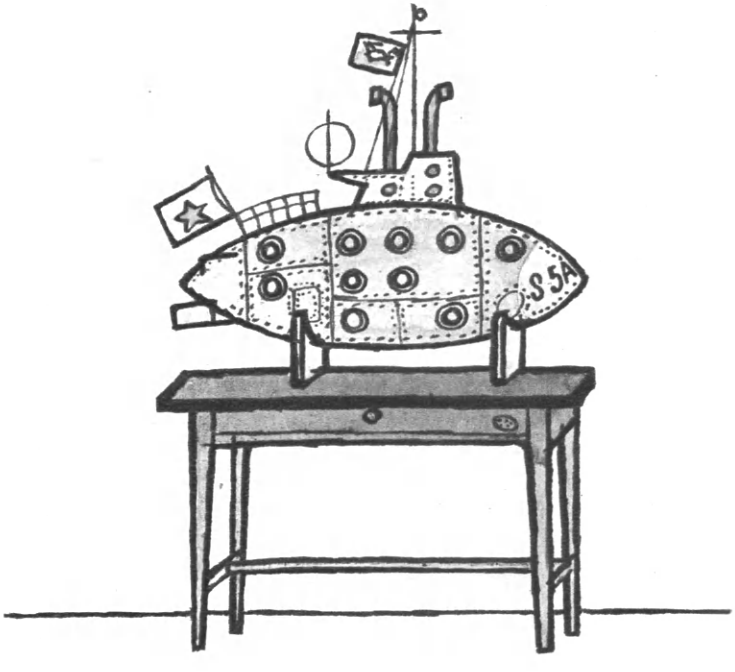


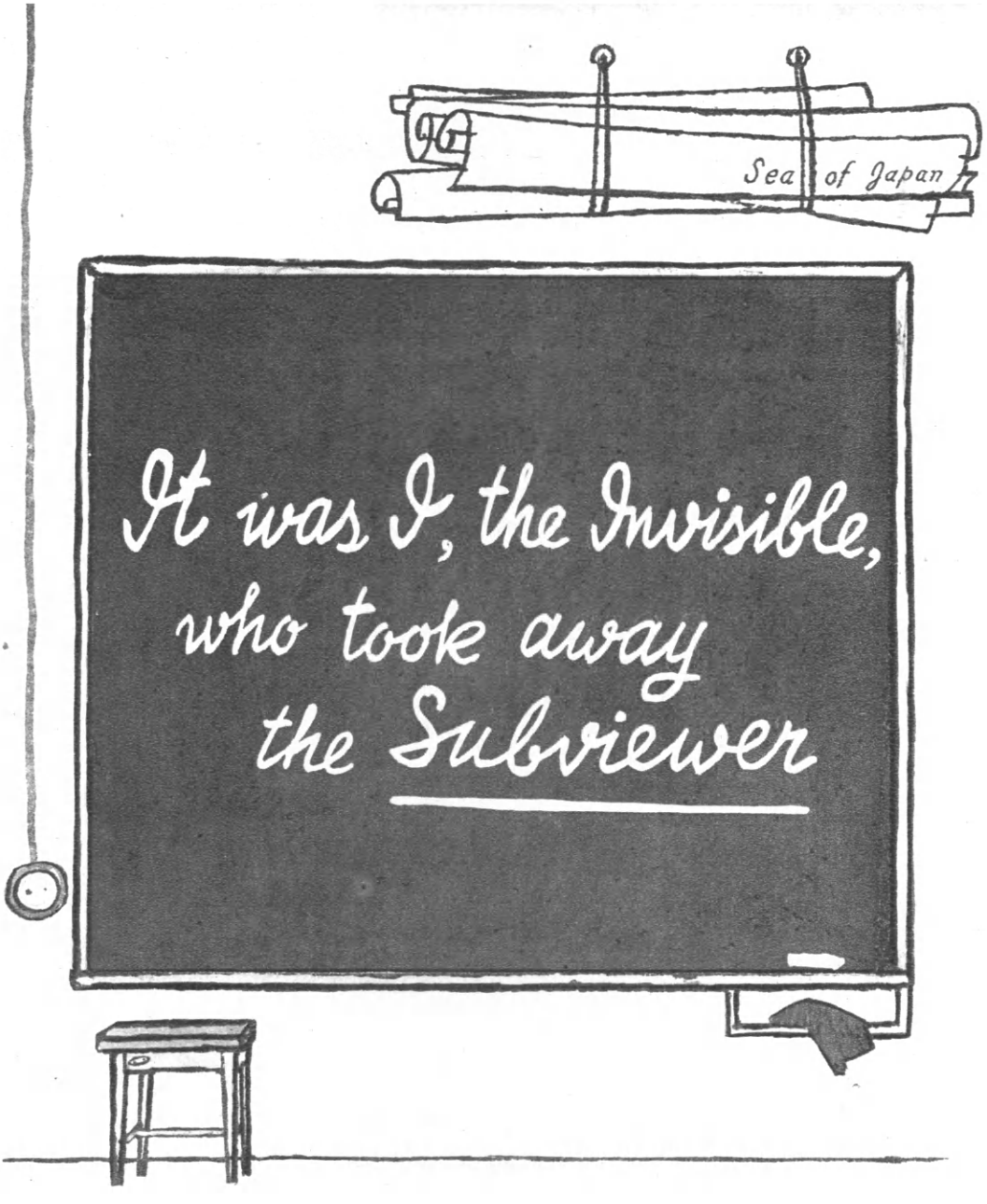
What was it? A depth charge? No, it was some frightened prawns that had released a shining slime to screen themselves. Where eternal night reigns enemies are scared away by light.

Once again there was a flare-up of light, but this time in the room, not on the screen. It was so strong that for a second I closed my eyes. When I opened them everything had changed. We were no longer sitting in the *Subviewer*'s mess but in our classroom, where our marine studies group usually got together.

"What's the meaning of this?" said the captain, recovering first. "Where's the *Subviewer*?"

Nobody knew. But don't imagine we saw our voyage in a dream. Written in big letters on the blackboard was:




Sea of Japan
It was I, the Invisible,
who took away
the Subviewer

What happened and what did not

"That's all," said Yura, closing the log.

You should have heard the din in the hall.

"That's not true, it can't be all! Read on, Yura!"

"How come you let the ship get away, you duffers? Or did you steal her yourselves?"

"We must bring her back anyway! Bring her back!"

"Try and do it when it's the Invisible One who's taken her away!"

"You believe that story? There are no invisible ones."

"Show us the Invisible One!"

"The Invisible One! We want the Invisible One!" the twins shouted at the top of their voices.

Anton Petrovich rose from his seat.

"It's very easy for me to meet your wish, children, because—*I* am the Invisible One."

"You!" gasped the audience.

"Yes. Maya's been my assistant and messenger."

A hush fell, and then a melancholy voice asked, "But why did you take away the *Subviewer*?"

"Why I took it away?" Anton Petrovich smiled. "If the *Subviewer* had continued her voyage, we'd have been unable to get together for a long time. I think her crew has learned enough about life in the sea to tell other boys and girls about it. That's why I stepped in and took away the ship. However, speaking frankly, there was nothing to take away. You see, the *Subviewer* existed only in the imagination of the boys and girls who thought up this game."

A fresh storm broke out.

"Ha, so it wasn't true! No such things happened!"

"You're wrong. Let the heroes and heroines themselves say the last word. Let the *Subviewer*'s crew tell us what happened and what didn't."

YURA. Who says no such things happened? We couldn't have thought up our game and all our adventures if we hadn't studied marine life in our group. All that's written in the log about life in the sea and the work of scientists is true. Of course, deep-sea television cannot yet look so deeply into the sea. At the moment it's only a dream. But there already exists the "Severyanka", a submarine with a TV-camera-mounted fore. By means of television we can observe life under water. The first peaceful submarine flying the Soviet flag is already ploughing the seas!

KATYA. I suggest to all boys and girls that they learn to swim. I've done it and it hasn't been a waste of time. When I grow up I'll spend my holidays like many Soviet sportsmen taking walks not only on the seashore but on the sea-floor too. Or maybe by the time I'm grown up there'll be deep-sea state farms and I'll be sent to harvest a crop. Wouldn't that be wonderful?

If you also dream of that, then I say to you: good-bye till we meet under water!

THE CAPTAIN. I don't know about the others, but I've been thinking of birds' sailing directions and of living barometers. You may ask why consult fish and birds when we have precision instruments, especially since in the future, signals from ultrasonic beacons will warn seamen of gales and typhoons. I'm fond of technology but I don't think the one is in the way of the other. You may rely on instruments but must use your wits too. The ability to observe is necessary everywhere—in the sea, in the woods and in the meadows. See?

MAYA. In many books of adventure, the characters have mysterious assistants. So I asked Anton Petrovich to be our Invisible One. He's our teacher. And a teacher always helps us, and he often does it without our knowing.

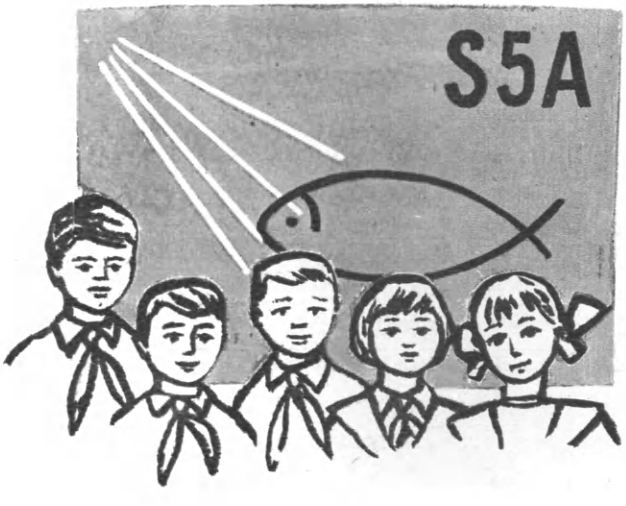
That's true, isn't it?

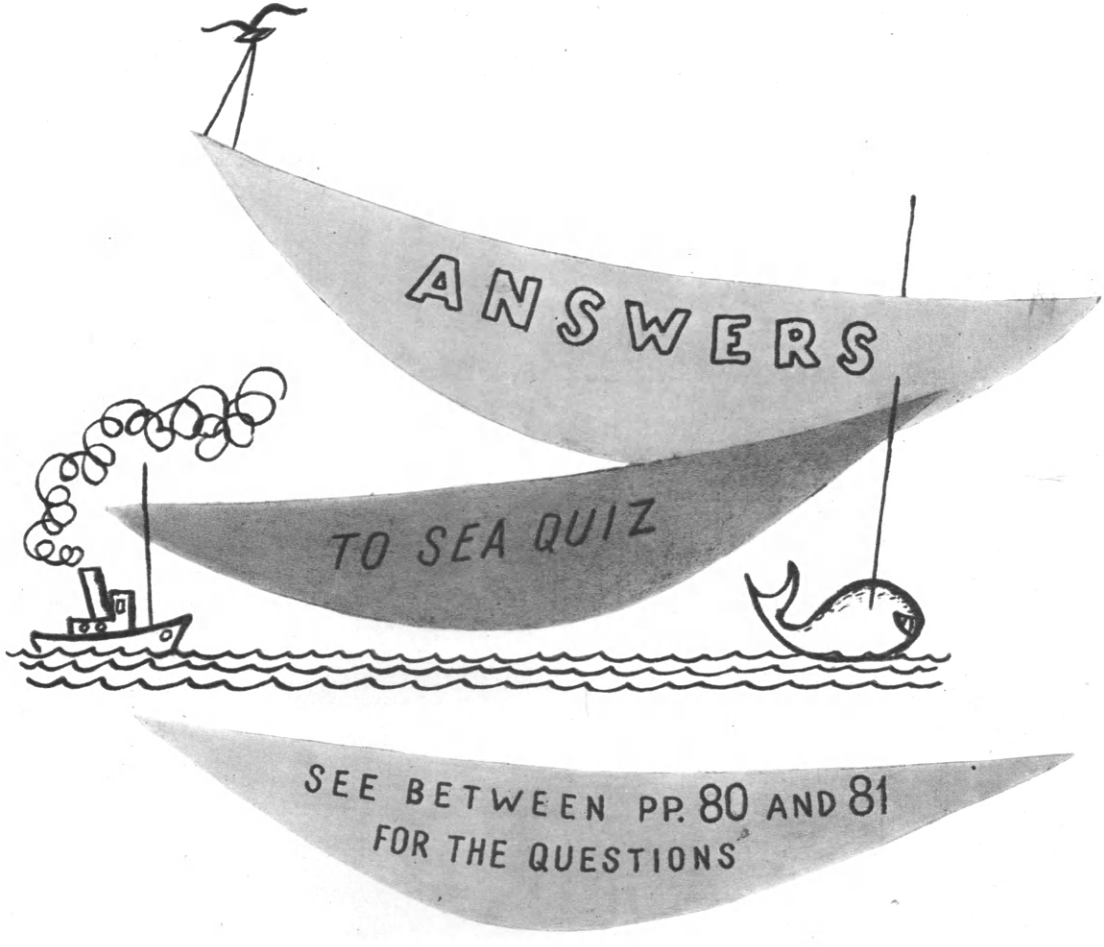
Now what would Keepmum say? He kept mum, as might have been expected. So I had to speak for him, Alyosha, and for the twins.

Perhaps after reading this book you will think up a *Subviewer* of your own and put to sea to find out the things that haven't been found out yet.

In the future you yourselves may want to explore the riches of the ocean and solve those of its mysteries still unsolved. Sea winds may become fair winds for you throughout your lives.

If so, what more can we say? Good-bye and good luck!




ANSWERS
TO SEA QUIZ
SEE BETWEEN PP. 80 AND 81
FOR THE QUESTIONS

1. and 2. The Red Sea is the warmest and saltiest of all. No rivers empty into it. It is surrounded by parched land and is continually evaporating. Its salt content is 43 to 46 grams per kilogram of water, or more than that of any ocean.

3. The Sargasso Sea, which in some places is 6,000 metres deep, is the deepest shoreless sea. (Remember that 1 m=3.28 ft.)

4. The shallowest sea is the Sea of Azov. If a whale shark could prop itself up on its tail and stand on that sea's floor, its head would stick out of the water. The Sea of Azov is 13 metres at its deepest while the whale shark measures 16 metres in length. But then this tiny sea abounds in fish.

5. The Mediterranean is famed for its blue colour. This is why catches are small in it—its blue, limpid water is poor in fish food, plankton.

6. The adult plaice.

7. The shark's mouth is under its snout. To grab its prey, the shark must either raise its head or turn over with its belly upwards.

8. In the crab's stomach there are three teeth with which it grinds its food. They cannot bite through the stomach because it is lined with a hard horny substance.

9. The pycnogonid, a spider-like marine animal. Its small body has very little room for intestines, and so these form excrescences that go deep into its legs.

10. Some bivalve mollusks move in the following way:
The mollusk puts its foot out from between the two parts of its shell like a tongue. The animal fixes its foot on the ground and by contracting its muscles pulls itself and its house forward.

11. If you grab an octopus by an arm the arm will come off, helping the mollusk to get away. In less than two months the octopus will grow a new arm, only a bit shorter.

12. The starfish, an echinopod, owes its name to its shape. It preys on oysters and mussels.

13. The penguin, an Antarctic bird, does not lay its egg on the cold ground but holds it between its feet, covering it with a fold of its belly.

14. The albatross, one of the largest petrels.

15. Linnaeus' worm, a thin sea worm, is 35 metres long—the same length as the largest whale.

16. The stickleback builds an underwater nest from the thin twigs of undersea plants and guards it carefully.

17. The date-mussle, a mollusk resembling a date in form and colour, bores passages in rock by means of an acid it secretes.

18. The thrasher shark. It has weak teeth but a very long tail—as long as its trunk. It breaks into a school of herring and stuns them by striking them with its tail.

19. The cuttlefish has in its body a bag filled with an inky fluid. This fluid can be used as ink and also goes into the making of sepia, a water colour so called after a cuttlefish of that name.

20. The teredo, a mollusk which is called the shipworm, feeds on timber. Using its shell as a file, it makes passages in the ship's timber, ruining the vessel. It begins to file its way when still a small larva, and gradually moves deeper into the timber. Because it grows as it advances it cannot go back by the route of its entry. In this way the burrower buries itself.

21. The sea turtle lays its eggs in a hole dug on a sandy beach. There may be as many as one hundred and fifty eggs in one turtle "nest". The turtle's young scamper into the sea as soon as they are hatched.

22. Young humpback hatched in a river go to the sea tail first.

23. The squid's colour becomes brighter when it sights its prey.

24. The sperm whale. The orifice of one of its nostrils is overgrown with flesh but inside it a channel remains that is linked with the lungs. As a result, the sperm whale can store up more air than other whales. It can stay under water for two hours.

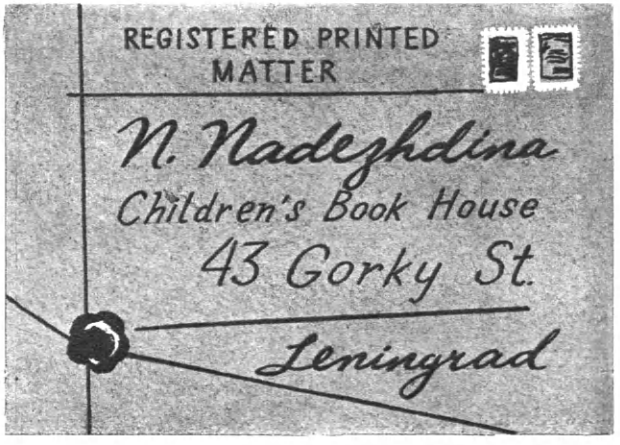
25. The walrus uses its tusks to dig shellfish out of the sea bottom.

26. The flying fish can fly more than a hundred metres. It does not move its fins but flies like a glider.

27. The sucking fish has a sucker near its head with which it clings to a shark. Many sharks carry more than one sucking fish. This fish can also "ride" a turtle. Fishermen in tropical seas use the sucking fish as a living bait to catch turtles.

APPENDIX 2

To be handed to the captains of future "Subviewers"



"Sign here," said the postman. "It's registered printed matter from Leningrad."

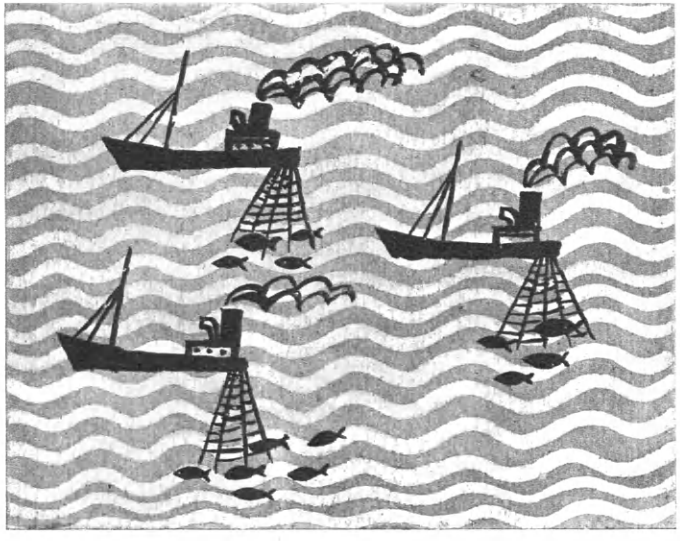
It was a bulky parcel. Inside was a folder containing azure, green and blue flags and a note.

Yes, I am to blame, although my omission may not have been noticed. The captain didn't spot it. It was Mitya who made a fuss. "Did you hear the broadcast from the Black Sea?" he asked. "You did? Well, where's its flag? Why haven't you painted it?"

I didn't forget it on purpose, honestly I didn't. And when I started painting that flag, which I had left out, I told myself that there are fourteen seas washing our shores. Perhaps other children would want to sail their own "Subviewers" in northern or southern seas, and then they, too, would ask, "Where are our flags?"

Here they are. I have painted them. On behalf of the crew of the S5A I ask that they be handed to future captains.

Best regards,
YURA K.



FLAG OF BARENTS SEA

Here are the flags, captains. Which of you will sail his ship from Murmansk to Chukotka by the Northern Sea Route? You? Good. Here are six flags of six Arctic seas. First you will hoist the grey-green flag of the Barents Sea.

If it had been customary to set up memorial plaques in seas, Barents Sea divers would read on one of them:

"1958. The *Severyanka* makes her maiden voyage. For the first time in the world a submarine engages in the peaceful pursuit of studying fish life."

Another plaque would read:

"1898. Here a trawl was used in Russia for the first time."

In tsarist Russia, the scientist N. M. Knipovich had to prove that a most profitable way to catch fish is with a trawl, that is, a net dragged over the bottom by a fishing vessel. We now have many trawlers, a whole fleet of them. In the Barents Sea they catch fifty times as many fish as were caught by earlier fishermen using ordinary nets.

Look, captain! A giant Cyanea jellyfish is going down into the depths. It's a storm signal. But your trawler continues to catch cod. A fishing vessel can fish in any weather.

Hard to port, captain! Let us run into the White Sea. Who will tell us about life in northern waters? The common mussel. To grow up, it needs to live five years in the Black Sea in the south, and twenty-five years in the White Sea in the north.

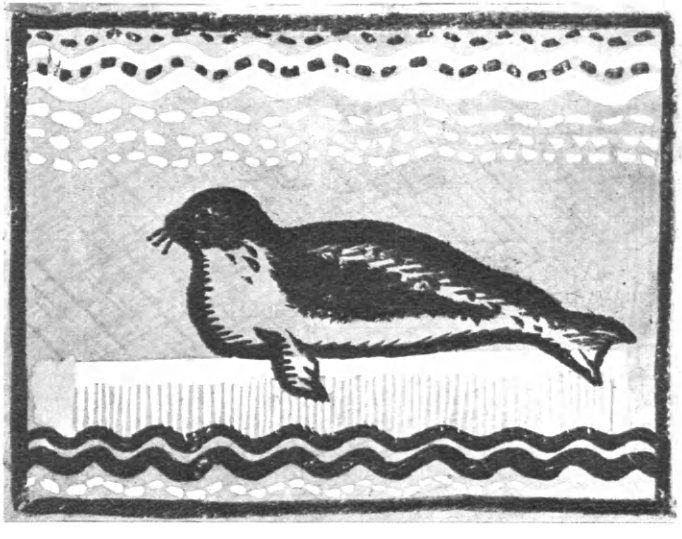
North Sea inhabitants are slow to grow but then they live long. In the White Sea, a sea of the long-lived, we may come upon cod more than twenty years old.

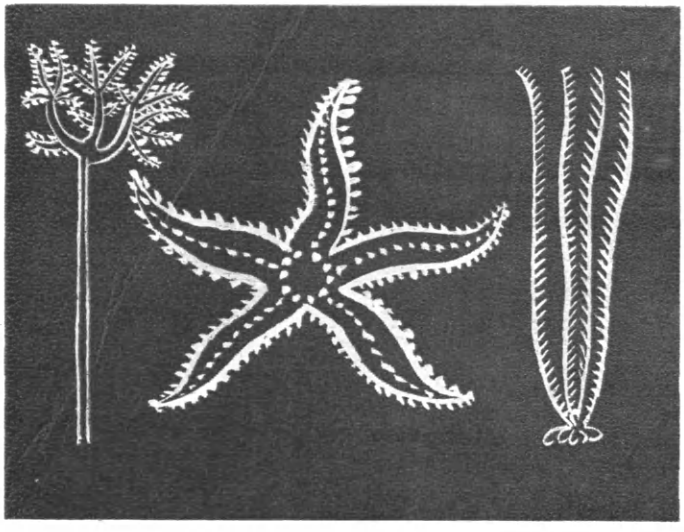
And we shall certainly come upon the Greenland seal. Nowhere are they so numerous as in the White Sea. That is why a seal is painted on the flag. It has an "icy" childhood. It is born on ice and there it lies during the first month of its life. It would freeze to death if it did not have its thick, warm fur.

In time the young white-furred seal changes its colour. The adult seal has black wing-like spots on its sides.

We are back on the Northern Sea Route. Hoist a new flag, that of the Kara Sea!

FLAG OF WHITE SEA





FLAG OF KARA SEA

Mollusks are few here because life is hard. They get smothered in the soft, rich ooze but the flat brittle star, as big as a dinner plate, lies on it without sinking. The sea lily buries itself in the ooze, waiting for its prey. The Kara Sea is a sea of echinoderms—brittle stars, sea lilies, sea urchins and starfish.

The waters of the Kara Sea are icy and the polar night broods over it for months. One doesn't have to go deep to see deep-sea creatures. They can be met in the upper storeys of the sea too, because it is as dark and cold there as they desire.

The fish here are all northerners. They include the vendace, smelt, nelma, dorse and Arctic plaice. But suddenly an Atlantic herring flits across our TV screen. What can that mean? It is an indication that the Arctic has become warmer.

Let us call at Dixon and stay at the polar station there for a while, and then head east again, towards the Laptev Sea.

The new picture shows the tramp of the Arctic, the polar bear. This bear does not hibernate but roams the icebound expanses throughout the long northern night.

Once this sea was called the Icy Sea, and few people ventured into it. Geographers established its outlines only two hundred and eighteen years ago. The sea was charted by the Laptev cousins, Dmitry and Khariton, lieutenants of the Russian Navy. More recently the sea explored by the two courageous Russians has been named the Laptev Sea.

It is no longer deserted. Ships following the route cut by icebreakers put in at Tiksi. However, sometimes it happens, as in the case of the *Sedov*, that an icebreaker itself gets trapped in ice.

Captain, we, too, are threatened by ice. You suggest we repeat the drift of the *Sedov*, during which very important scientific observations were made. But the *Sedov* drifted for eight hundred and twenty days while we must hurry. So please sail on.

Keep your eyes open, captain! Things get even tougher in the East Siberian Sea. There the currents carry the ice both from the sea into

FLAG OF LAPTEV SEA

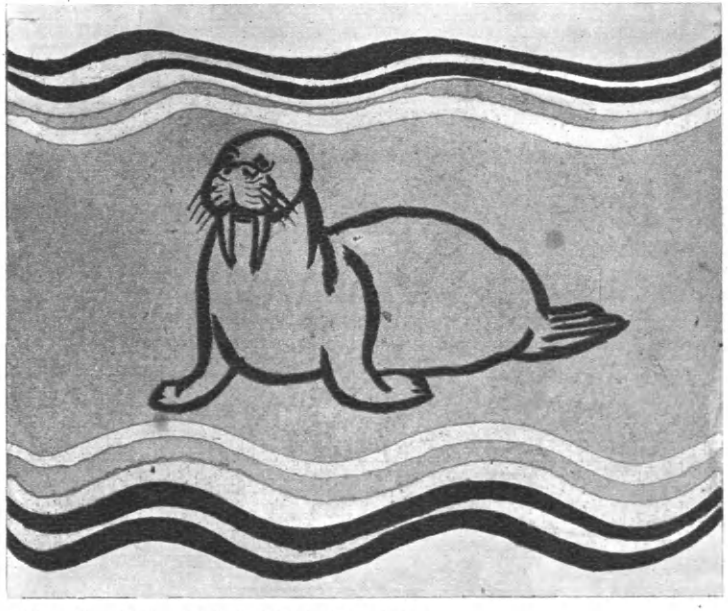
FLAG OF EAST SIBERIAN SEA

the ocean and the other way round. And yet the whole of that ice sea has become navigable.

In the past it was like this: a ship would take three years to circle the globe, sailing from the Baltic to the Far East via Africa. The shorter route through the northern seas was considered impassable. Throughout the history of navigation, before the establishment of the Soviet state, only the Swedish ship *Vega* and two Russian ships, the *Vaigach* and *Taimyr*, covered that distance in two navigation seasons.

But in 1932 the *Sibiryakov*, a Soviet ice-breaking steamship, weighed anchor at Archangel and arrived in the Far East a mere sixty-five days later.

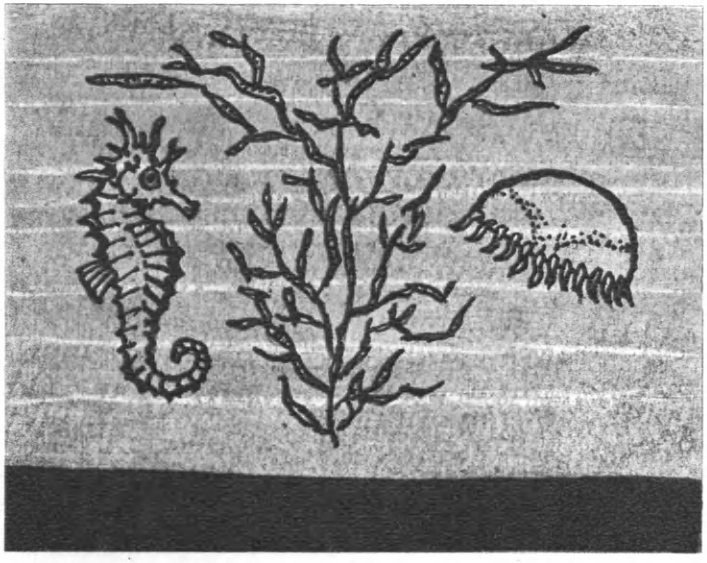
That is how the Northern Sea Route was opened. Since then ice-breakers have been leading the way for ship convoys with various cargoes, including coal and timber for Arctic building projects. The Soviet Arctic fleet is now led by the *Lenin*, the world's first atom-powered icebreaker.



FLAG OF CHUKCHEE SEA

Our voyage is coming to an end. We have arrived in the Chukchee Sea. Millions of Soviet people were thinking of this distant sea in the winter of 1937. School children made songs about the cold ice on which the Chelyuskinites had landed. Their ship, the *Chelyuskin*, had been crushed by ice. How everybody worried about them and how great was the relief when they were picked up! The courageous flyers who rescued them were the first in our country to be awarded the title of Hero of the Soviet Union. They lifted the Chelyuskinites from the icefloe in the nick of time, for the ice might have cracked or melted at any moment.

In the summer so much ice melts in the Chukchee Sea that the water becomes less salty than in the winter. In summer, Pacific Ocean fish come here through the Bering Strait, along with the warm waters. Walruses bask in the sun on the deserted beaches. The walrus breeding ground there is the largest in the world. That is why a walrus is painted on the flag of the Chukchee Sea. It is our last northern flag.



FLAG OF BLACK SEA

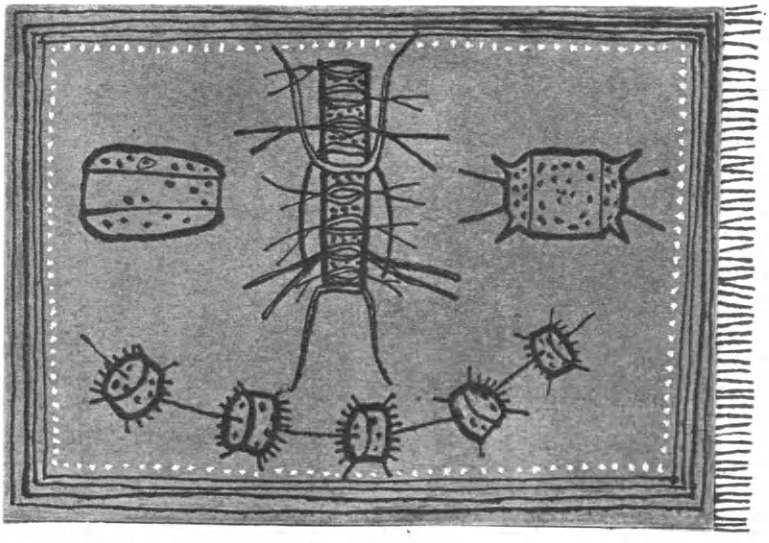
But Yura's parcel contains another four. South sea captains! They are your flags.

The flag of the Black Sea is blue-green.

The dark strip running along the lower part of the flag indicates that there is not a living creature in the Black Sea below a hundred and fifty metres. Farther down the sea is saturated with hydrogen sulphide.

But at lesser depths there are ray, pipefish and seahorses and various other fish, and also crabs and mollusks. But how did this one get there? Why, it came as a stowaway.

Nobody invited the tuna and mackerel to the Black Sea but they came of their own accord from the Mediterranean. So did the grey mullet, anchovy and numerous other migrants. You can no longer tell which are the real masters of the Black Sea, these newcomers or indigenous fish like the herring or bullhead. Fishermen treat them alike. They just make haste to take the anchovies before they depart to the Sea of Azov to feed.

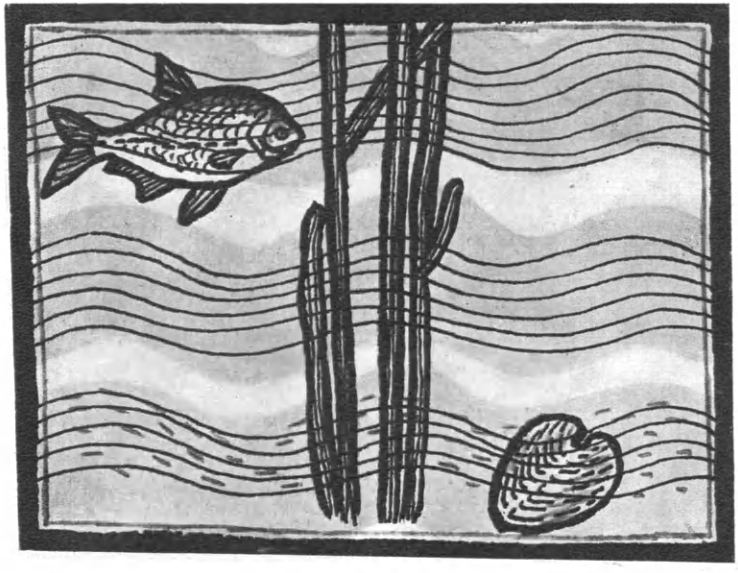


FLAG OF SEA OF AZOV

What are these queer-looking little shapes on the dark-green flag of the Sea of Azov? They are vegetable plankton. In some places in the summer they grow so densely that for a quarter of a metre deep nothing can be seen but a green mass. The mass is made even denser by shellfish, larvae and fry scurrying about in it.

In the summer the sea is calm. Its green water is still. And then the fish begin to die. The inhabitants of the populous upper storey have used up almost all the stock of oxygen, with little left for those living close to the bottom. But a wind springs up. The shallow sea is easily mixed, and all of its inhabitants can breathe and live again.

And life there is easy—there is warmth and plenty to eat. Any fish, such as, say, the Azov bream, will confirm this. At six years of age it can vie in size with its eight-year-old Aral counterpart. And how fast the bullhead grows there! The tiny Sea of Azov is the world's most productive sea. It is richer in fish than the Aral Sea, which is twice its size.



FLAG OF ARAL SEA

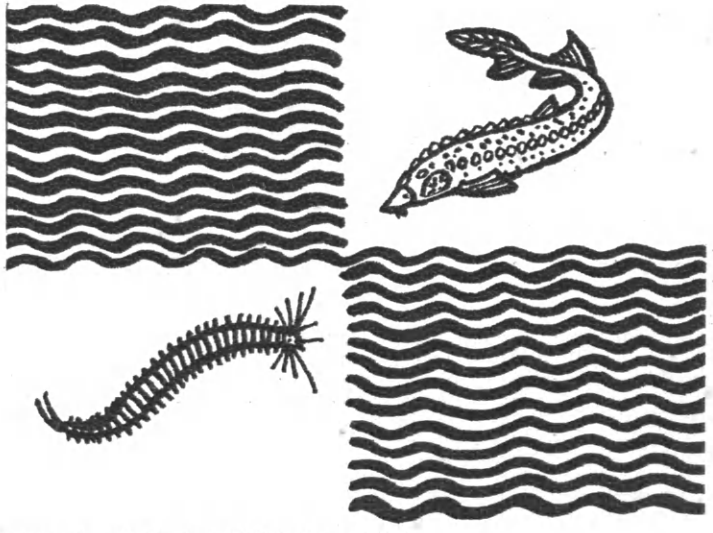
In olden days the Aral was called the Blue Sea.

Silvery schools of fish flash in the clear blue water. While the Sea of Okhotsk is a salmon sea and the Barents a cod sea, the Aral is a sea of goldfish and bream. These are fresh-water fish.

Fish can never make their way into the Aral Sea from the ocean. It's impossible because the sea is surrounded by yellow sands on all sides. It is cut off from the ocean.

But perhaps it is not a sea but just a huge salt lake?

Well, look at the blue flag of the Aral. It shows not only the fresh-water goldfish but sea grass and the cockle, an edible mollusk. Neither sea grass nor the cockle lives in lakes. This mollusk comes from the Mediterranean. It is also found in the Black, Azov, Aral and Caspian seas. Scientists say that at one time all these seas were one huge body of water called Tethys, which has disappeared for ever from the face of the earth. The two inland seas, the Aral and Caspian, lie amid sands.



FLAG OF CASPIAN SEA

Why is the Caspian herring called Caspian?

Because it differs from other herrings. The Caspian is a separate and special world. Most of its inhabitants live nowhere else.

No new marine creatures make their way into the Caspian. But there are new settlers in the Caspian as well. They have flown, not swum there.

The Caspian is a birds' sea. In the summer flamingoes can be seen strutting in the water and pelicans fishing. In the autumn flocks of geese, swans, gulls and ducks arrive. Long ago some of them brought in the minute plankton alga called the rhizosolenia on their feet and it multiplied freely in Caspian waters.

Other new settlers have also arrived by air, but it was man who brought them. Planes brought and released into the Caspian the Leandria serratus prawn, young grey mullet and the clamworm.

The clamworm is the best food for sturgeon. But formerly it was not found in the Caspian. That is how man helped the sturgeon.

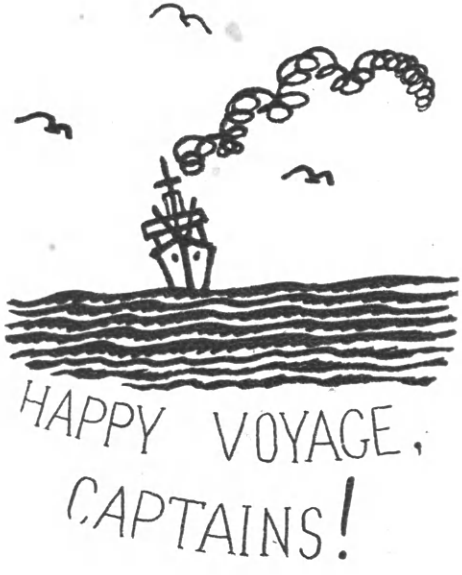
But more help is needed. Not only the sturgeon but other fish as well as shrimps and mollusks are asking for help. In fact, the whole sea is asking for assistance.

The old, grizzled Caspian is growing shallower as it gives way to sands. Its level has dropped by almost two metres during the past twenty years.

What is to be done? How can we raise the level of this sinking sea? We must pour water into it from more rivers.

Scientists propose building canals to link the Vychegda, a tributary of the Northern Dvina, and the Pechora with the Kama, a tributary of the Volga. Then the Volga will carry the waters of northern rivers to the Caspian. And the dwindling sea will revive.

Man is equal to the most difficult tasks. He can also help the sea.



TO THE YOUNG READER

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